THE HISTORY AND STATISTICS OF AMERICAN WATER-WORKS.

BY J. JAMES R. CROES, M. AM. SOC. C. E.

(*Continued from page 136.*)

DXVI.—HUNTSVILLE, ALA.

Huntsville, Alabama, in lat. 34° 36' N., long. 86° 57' W., is on the foot hills at the western base of the Cumberland Mountains. It was settled about 1813.

About 1825 water was conveyed to the public square in bored logs from a copious spring which flowed from a limestone bluff 40 feet high, about 400 feet from the centre of the city, on land owned by Dr. Thomas Fearn. The daily yield of the spring is 2,000,000 gallons. In 1836 an agreement was made between Dr. Fearn and the City Council, by which both parties united in building a reservoir holding 200,000 gallons, 40 ft. above the public square, and 85 ft. above the spring, and the Doctor put in a turbine wheel and pump which lifted the water to the reservoir, laid pipes, and collected water rents. In 1858 the town purchased the works and spring for $10,000. In 1869 a Worthington duplex steam pump was erected, for use when the water-power is insufficient, which is now about half the time. Distribution is by 4 miles of cast-iron pipes of 8 to 3 in. diameter, with 20 fire hydrants, 12 gates and 200 taps. The population in 1880 was 4977. The daily consumption is not given.

The expenses in 1881 were $2,125.33, and the receipts $2,110.

DXVII.—LONG ISLAND CITY, N. Y.

Long Island City is on the northwestern point of Long Island, opposite to the central part of New York City, and adjoining the city of Brooklyn. It was incorporated under its present name in 1870. Its surface is level.

Water-works were built in 1874 by the city, after plans of W. E. Worthen, C. E., taking his supply from a well 50 ft. in diameter, sunk 30 ft. into the saturated sand, which forms what is called the main spring of Long Island. The well has a 16 in. brick wall, resting on an iron shoe, and was sunk 30 ft. by excavating inside, and letting the wall settle. In the bottom of the well, which is 20 ft. below the level, three 4 in. pipes are driven 20 ft. In 1882 six 6 in. pipes were driven from 75 to 90 ft. deep a short distance from the well, and connected with the suction pipe of the pumps. The water is pumped directly into the mains by four piston pumps, built by the Holly Manufacturing Co., and two rotary pumps for fire pressure.

In 1879, another well 15 feet in diameter and 20 ft. deep was sunk about 3 miles north of the first one. From this the water is pumped into the mains by two Garrison steam pumps. The ordinary pressure maintained is 45 lbs and the fire pressure 70 lbs.

Distribution is by 16 miles of cast-iron pipes of from 18 to 4 in. diameter, with 250 fire hydrants, 85 gates and 1,050 taps. There are 27 meters in use. The population in 1880 was 17,129. The daily consumption in 1882 was 1,500,000 gallons. No information is furnished as to the cost of the works or the bonded debt. The expenses in 1882 are stated to have been $12,000 and the receipts $37,000. The works are managed by a Board of Commissioners.

DXVIII.—COLLEGE POINT, N. Y.

College Point, New York, in lat. 40° 47' N., long. 73° 50' W., is on ground gently sloping up from the south shore of Long Island Sound.

Settled in 1652, it was incorporated in 1865.

Water-works were built by the village in 1875, after plans of W. E. Worthen, C. E., taking the supply from Fresh Meadow Brook about two miles from the village, with a drainage area of 9½ square miles of gravelly knolls. Kissena Lake, which receives the water of the stream, was excavated and walled, making a storage reservoir.

The water is pumped directly into the mains by a Worthington duplex steam pump with 55 lbs. ordinary pressure, For fire service there is a Worthington duplex pump with 20-in. steam and 12-in. water cylinders with 15-in. stroke.

Distribution is by 14 miles of cast-iron pipe of 12 to 6 in. diameter, with 54 fire hydrants, 449 taps and 52 meters. Service pipes are of lead and galvanized iron.

Population in 1880, was 4,192. Daily consumption in 1882 was 350,000 gallons. Works have cost $212,000. The bonded debt is $2,000 at 7 per cent. The expenses in 1882 were $5,000 and the receipts $8,600. Jacob Koerber is the Superintendent.

CANADIAN PACIFIC RAILWAY.

CONTRACTOR'S STAFF CANADIAN PACIFIC RAILWAY, BRITISH COLUMBIA.—GENERAL OFFICE AT YALE.

A. Onderdonk, Contractor; Edward G. Tilton, Chief Engineer and General Superintendent; Georgr F. Kyle, Assistant to General Superintendent; E. T. Scoville, Division Engineer Contracts 60 & 61; E. P. Roberts, Assistant Engineer; G. W. Campbell, Chief Timekeeper; John Trutch, Auditor; Henry B. Havens, Cashier and Paymaster; E. A. Cunningham, Chief Accountant; John T. Ward, Correspondent; Frank Jarvis, Bookkeeper; Charles Rhodes, Clerk; S. Green, Clerk; Paul Marmette, Draughtsman; Benj. Wright, Messenger.

YALE SHOPS.—E. W. Harris, Master Mechanic; George Monroe, Train Dispatcher, etc.

EMORY WAREHOUSES.—John P. Bacon, Commissary; Wm. L. Ward, Clerk; George P. White, Clerk; Howard Tilton, Freight Agent.

12-MILE FLAT WAREHOUSES.—W. S. Scovill, Fred. Fay, W. J. Cartwright, Clerks.

CONTRACT 60.—James Leamy, Riding Boss; P. H. Keough, Bridge Overseer; J. B. Smith, Wm. T. Preston, F. T. Holt, Timekeepers; F. T. Bell, Clerk.

CONTRACT 61, SALMON RIVER.—A. J. McLellan, Riding Boss; F. X. Grubbs, Clerk; Henry Berry, Timekeeper.

CONTRACT 61, HAUTIER'S STATION.—S. P. Tuck, Division Engineer Contracts 62 and 63; George Townsend, Commissary and Cashier; Robt. Jesse, Bookkeeper; Fred Robson, Herbert Tappan, R. P. Hillman, Clerks; Gerald Robinson, J. H. Jarvis, Timekeepers; J. R. Onderdonk, Bridge Overseer.

CONTRACT 92.—Thomas Daly, Riding Boss; J. L. O. Hamilton, Riding Boss; R. H. Simonds, Clerk; P. Braun, S. T. Tilley, H. P. Orton, R. B. Irving, E. D. Sother, Timekeepers.

MEDICAL STAFF.—E. B. C. Hanington, M. D., Yale; S. Tunstall, M. D., Lytton.

The portion of the Canadian Pacific Railway now under construction in British Columbia is the link connecting the western end of Kamloops Lake, at Savona's Ferry, with Port Moody, the Pacific terminus on Burrard Inlet, Gulf of Georgia. This link is divided into five sections of contracts, all held by A. Onderdonk and associates, who are pushing their great undertaking to completion with a vigor and energy that command the admiration of both tyro and professional. These contracts or sections are :

Contract 60 (Section A), Emory to Boston Bar, 29 miles in length.

Contract 61 (Section B), Boston Bar to Lytton, 29 miles in length.

Contract 62 (Section C), Lytton to Junction Flat, 28½ miles in length.

Contract 63 (Section D), Junction Flat to Savona's Ferry, 40½ miles in length.

Contract 92, Port Moody to Emory, 85½ miles in length.

The total mileage embraced in the above contracts amounts to 212.5, and the estimated cost is $9,328,000; adding $250,000 for the bridge spanning the Fraser at Cisco Flat, makes the total estimated cost for the finished road, from the sea to Savona's, $9,578,000, exclusive of the rails and fastenings, which are furnished by the Dominion Government for the four upper sections.

The first four contracts were let in the winter of 1879, and ground was broken thereon in the early spring following before the snow had yet disappeared, and work has continued uninterruptedly ever since, despite the severe winter and unprecedented freshets that have occurred. The contract for the western section, between Port Moody and Emory, was taken at the beginning of the present year, and work inaugurated almost immediately thereafter.

Taken as a whole, the section between Emory and Savona's is probably more difficult to construct and contains a greater quantity of material, and a larger number of bridge and trestle structures, than any other piece of railway of the same length ever constructed in North America. That portion between Emory and Boston Bar is, without doubt, unapproached on this continent in its magnitude, and only finds parallel in the great trans-andean and trans-alpine roads of Peru and Switzerland. This section embraces 29 miles, of which 9 are light work. The average cost per mile is $80,000, several individual miles costing $200,000. There are thirteen tunnels in 19 miles of this distance, one series of four in the first mile out of Yale, and another series of six occurring in a section of 7,000 ft. further east. For 20 miles the road-bed is literally hewn out of the solid granite, narrow places being made up with substantial masonry, and ravines, gulches and rivers crossed by handsome and lofty trestles and truss bridges.

From Yale to Boston Bar the Fraser finds a passage in the deep and narrow gorge cleaving the heart of the Cascade Range, with bold, precipitous walls thousands of feet in height flanking it on either side. This cañon offers a natural, low level route between the sea and the interior table land, but its wild and rugged depths present a defiant front that would appal any but the railway builder of the present age.

To within twelve miles of Boston Bar construction was greatly facilitated by a rough wagon road already built, but beyond that point it was necessary, before a blow could be struck, that a pack trail should be built, which was done at enormous cost, and, when finished, could only be traveled by the confiding mule and steel-nerved mountaineer. The immense quota of heavy and varied plant, powder and supplies to keep several thousand men at work was transported over this steep and sinuous trail, which now gives way to the rail and locomotive, steadily advancing to the front. The grade on this section is about completed, and as fast as the bridging—perforce built with timber carried forward by train—is finished, the rails creep ahead, and the iron way will soon be laid across the entire section.

Owing to the heavy character of the work it was necessary to attack it at various points in order to complete the undertaking within reasonable time; grading, therefor, has been in progress since the inauguration of the work on the several sections as far east as Junction Flat. At this writing grading, bridging and tracklaying are being carried on in several places between Harrison River and Junction Flat, a distance of 131 miles. Following the Fraser and Thompson Rivers from Boston Bar, although the work is extremely heavy, the material classification is chiefly earth and the line is far more accessible than in the gorge of the Fraser; and by comparison is handled with ease, but it nevertheless presents many difficulties to construction.

Below is given a table of the estimated quantities and classification of material to be moved on each of the four sections between Emory and Savona, as well as the estimated cost of the work.

SECTION A.—Length, 29 miles; earth, 765,000 cubic yards; loose rock, 280,000 cubic yards; solid rock, 600,000 cubic yards; total yards, 1,645,000; 13 tunnels; estimated cost, $2,324,000; per mile, $80,000.

SECTION B.—Length, 29 miles; earth, 1,125,000 cubic yards; loose rock, 400,000 cubic yards; solid rock, 400,000 cubic yards; total yards, 1,925,000; 3 tunnels; estimated cost, $1,755,000; per mile, $60,000.

SECTION C.—Length, 28½ miles; earth, 1,600,000 cubic yards; loose rock; 170,000 cubic yards; solid rock, 170,000 cubic yards; total yards, 1,940,000; estimated cost, $1,370,000; per mile, $48,000.

SECTION D.—Length, 40½ miles; earth, 1,600,000 cubic yards; loose rock, 44,000 cubic yards; solid rock, 95,000 cubic yards; total yards, 1,739,000; 4 tunnels; estimated cost, $1,392,000; per mile, $34,000.

TOTAL FOUR SECTIONS.—Length, 127 miles; earth, 5,090,000 cubic yards; loose rock, 894,000 cubic yards; solid rock, 1,265,000 cubic yards; total yards, 7,249,000; 20 tunnels; estimated cost; $6,841,000.

Estimated average cost per mile, for 127 miles, $54,000, exclusive of the Fraser River bridge, on section B.

The Port Moody-Emory section is a bulk sum contract, amounting to $2,487,000, for 85½ miles, costing on an average $30,000 per mile. For sixty miles, where the line traverses the alluvial valley of the Fraser, the work of grading is very light, but in the last twenty-five miles toward Emory, extremely heavy rock work and tunneling is encountered.

In the 85½ miles are 2,700,000 cubic yards of earth excavation, 80,000 cubic yards loose rock, and 575,000 cubic yards solid rock, in all 3,355,000 cubic yards, adding which to the 7,249,000 cubic yards on the four eastern contracts, maks a grand total of 10,600,000 cubic yards, exclusive of tunneling to be moved by pick and powder from Savona to the sea.

The amount of bridging and trestling along the entire line is very large; many of the five hundred structures are of considerable magnitude, the grandest being the lofty, three-spanned cantilever steel and iron truss crossing the Fraser over a chasm eight miles below Lytton, at the confluence of the Thompson.

The roadway for this great northern transcontinental railroad is far superior to that of its southern competitors. The cuttings are formed to width of 22 ft. and the embankments 17. The tunnels are 22 ft. wide by 21 in height. The bridges are of the heaviest Howe truss type, and the trestles correspondingly strong. Track is laid with 60 lb. steel rails, and is thoroughly sleepered and deeply ballasted. The alignment and grades, for a mountain road, are easy and economical.

To level a pathway made so difficult by volcanic upheavals and deep river drift, a vast army of laborers and mechanics, numbering upward of 7,000 souls have been assembled, who, with the aid of the most modern machinery ingenuity has devised, are all striving to accomplish by July, 1885, the great task set before them. What has been already effected and the thorough organization that prevails leave no room for doubt that their exertions will be rewarded by viewing this work an accomplished fact probably before the date above appointed. Whatever may be the vicissitudes that overtake them, and the embarrassment that nature and the elements interpose to baffle their efforts, they never pause, never falter, but grimly forge ahead and conquer.

At this writing the track is laid 23 miles east of and 7 miles west of Emory, making 30 miles in all. By the end of the coming year it is expected to have uninterrupted communication by rail

between Port Moody and Lytton, a distance of 143 miles.

The contractors have made Yale, at the head of navigation on the lower Fraser, their headquarters, and at that point are located the general offices, the accident hospital and the construction and repair shops. These shops, although not extensive, are very complete, being fitted up with the most improved iron and wood working machinery necessary for car and engine construction, repair and general work.

In the vicinity of Yale the company have also thoroughly complete works for the manufacture of acids and nitro glycerine, with a capacity of 2,000 lbs. per day of the highest grade of explosives. It is pleasant to be able to record that no accident has ever occurred at these works during the two years they have been in operation.

At Emory, five miles below Yale, are situated the vast storage warehouses for materials and supplies, which are issued from this point to the various camps along the line. There are three saw mills belonging to the company engaged exclusively in sawing bridge and construction timbers. There are also two steamboats owned and operated by the contractors as tenders along their works. One on the lower Fraser and another, the intrepid Skuzzy, the pioneer steamer of the upper river, the staunch little craft whose perilous history and success are fresh in the memories of our readers, whose wake whitens the broad, troubled waters of the mighty Fraser between Boston Bar and Lillooet.

The writer, who has often visited these great works and here feebly essays to portray their salient features, has great gratification in attesting to the humane treatment, excellent food, comfortable lodging and fair wages that are given to those sturdy workers gathered there. Contentment apparently prevails, and this is the surest indication that kindness tempered with consideration is the policy of the management. The care which is constantly exercised for the personal safety of the men, engaged as they almost all are in hazardous work, is manifested by the fact that only 32 persons have lost their lives through accident since April, 1880, up to the present time. November, 1882, out of a daily average of over 4,000 men employed during that period.

All able-bodied workers can find employment by applying on the works. Stone cutters, bridge carpenters, and timber men generally are in demand, and steady work assured them. Appended is a schedule of wages paid to several classes of labor employed: Bridge carpenters, first class, $3.50; second class, $3; masons, $3.50; blacksmiths, first class, $3; second class, $2.50; helpers, $2; drillers, $1.75 to $2; laborers, $1.75; first class hewers, $3.50; first class choppers, $2.50; first class scorers $2 50. All outside labor ten hours per day. All employés find themselves bed, board and lodging. Boarding-houses will be located at convenient intervals along the line. Board, $4 per week. It will not be compulsory for employés to board in the company's houses. Wages will be paid monthly, on the 10th of each month.

DE LESSEPS AND HIS MIRAGE.

A telegraphic line, printed yesterday, gave the information that M. de Lesseps had reached Gabes on his way to the desert of Sahara, which he proposes to convert into a great inland sea by turning upon it the waters of the Mediterranean through an artificial canal. He is impressed with the belief, which many others have shared, that in pre-historic times the indentation of the north African coast which forms the gulf of Gabes—or Cabes, as it is sometimes called—extended southward until it covered an immense area which is now a desert of sand, leaving the Mountains of the Moon and a strip of fertile territory—included at present within the limits of Morocco, Algiers, Tunis, and Tripoli—between it and the Mediterranean, and having for islands the numerous oases which now dot the desert. It is by excavating the sand hills and letting the waters of the gulf through again that De Lesseps hopes to reconstruct the ancient distribution of land and water in the northern part of Africa. If 1,000,000 square miles of scorching desert can be converted into a placid sea, it is obvious that great climatic changes will be produced; that the deadly simoon will be no more; that "the immense furnace, heating Arabia, Asiatic Turkey, and Europe," as Malte-Brun calls it, will become extinguished; that Egypt will cease to be rainless; that the long caravans with camels will cease to travel the skeleton-maked way to Timbuctoo, and that European commerce will reach the heart of Africa through cities that as yet have no site and harbors that are a thousand feet deep with sand.

No traveler who ever fainted among the Arabs has seen such visions of fair towns, palm trees, and blue waters in the desert, as now appear in the eyes of M. de Lesseps; no phantasmogoria has ever hung upon the earth and air so splendid as the mirage of the great desert of Sahara which the enthusiastic French engineer beholds from the Gulf of Gabes.

The government, while M. de Freycinet was at the head of the cabinet, gave encouragement to the scheme so far as the filling of certain depressions lying along the southern border of Tunis was concerned, with the idea that not only might the climate be improved where the French possessions lie, but that the body of water would be a protection from hostile incursions of the wild Arabs of the south. It is understood that the exploration which De Lesseps now has in hand is favored, and probably paid for, by the national authorities at Paris. Indeed, such partial surveys as have already been made indicate to other competent engineers the probability that the line of dry lagoons, called *chotts*, lying immediately south of the French possessions in Tunis and of the Algerian province of Constantine, are the only natural depressions that exist of sufficient dimensions to be worth considering. One of these—the *chott* Mel-Rir—was found by obesrvations made about 30 years ago to be more than 60 feet below the level of the Mediterranean, and it was rather hastily assumed that there was a vast natural basin in the Sahara that could at any time be filled with water and made navigable for large ships by the simple process of cutting a canal through the rise of land that lay between it and the coast to the north. The idea was, in a general way, to reproduce a sea that had become extinct merely because its connection with the ocean was choked up, leaving its water to be dried away in the sun. The *chotts* were supposed to be identified with a certain Lake Triton, mentioned by some ancient geographers as existing in their time, but which, they said, had only recently been cut off from the Mediterranean by a bar formed of alluvial deposits. It was thought by some that this bar could be recognized as the coast line near the city of Gabes, though most of the old authorities placed it 500 miles further to the East. A French investigation seemed to upset this theory by showing that the coast ridge at Gabes was geologically much older than an alluvial formation would be; that it was of great breadth and 130 feet in height. Worse than this it was found that the greater part of what had been supposed to be the bed of Lake Triton was 40 or 50 feet above the sea level.

There is no certainty from any surveys already made that there is any spot low enough to receive water from the Mediterranean except the *chott* Mel-Rir, and this has an area of only about 5,000 square miles, or say seven times the size of Lake Geneva. To fill even this would require a canal at least 180 miles long, across a country having a height above sea-level of from 45 feet at the lowest to 135 in ridges. The canal would have to be six or seven hundred feet broad and over 30 feet deep to carry water enough to overcome the evaporation, which M. Duponchel, a distinguished student of geography and climatology, says, in the *Revue des Deux Mondes*, would take place at the rate of more than 100,000 cubic yards per second. The labor of making such a canal would be ten times as much as was expended on Suez Canal, and it is not apparent that there would be any result sufficient to justify such an outlay. It would seem that a land-locked basin incessantly refilled with sea-water must in time, by continual evaporation, become filled with solid salt. Even while it remained open, M. Duponchel is of opinion that it would have hardly a perceptible effect upon the climate of the neighborhood, for the vapor would be taken up by the winds and carried to distant regions.—*Detroit Post and Tribune.*

THE FOUNDATIONS OF WATERLOO BRIDGE.

A very interesting piece of engineering work is, says the *London Daily News*, just now in progress at Waterloo Bridge, though considering that this famous structure was opened only about sixty-six years ago, it is a piece of work that ought not to have been necessary in our day. When, four or five years ago, the Metropolitan Board of Works purchased this bridge for £475,000, it was done, we believe, in the full knowledge that there were symptoms of decrepitude indicating a subsidence of some of the piers, such as would probably demand a considerable outlay upon it. About twelve months ago the work of repair was commenced at the Surrey side of the bridge, and is now going on right in the middle of the river.

Passengers over the bridge may see indications of what is going on below; but without making a rather perilous descent from the parapet right down to the foundations of the structure, they will hardly be able to form an idea of the extensive and difficult nature of the undertaking with which the engineer to the bridges belonging to the Metropolitan Board. Mr. Edward Bazalgette, is charged. The first thing to be done was to ascertain the cause of the ominous cracks discovered here and there about the bridge, and for this it was necessary to examine the foundations. Dams were made round portions of the piers by driving in huge piles and caulking up the interstics between them with oakum or puddling with clay. The water was then pumped out, and the mischief was at once revealed. The subsidence of the bridge was quite apparent. Each pier from which the arches spring is apparently based on huge blocks of rough stone of the kinds technically known as Bramley Fall and Craigleith, and these blocks have been visibly crushed down by the superincumbent mass, calculated to bear with a pressure of somewhere about 11,000 tons for each pier. The "cutwaters"—the pointed projections intended to break the force of the current against the piers—not being a part of the actual bridge, have retained their original level, and afford therefore a gauge by which the dropping of the bridge between them may be clearly perceived. To ascertain the real cause of the subsidence it is necessary to go below the "footings," the huge blocks which, as it has been said, constitute the apparent base of the pier. They in their turn rest on a foundation of wooden piles, which originally, no doubt, were imbedded to a depth sufficient to insure their perfect stability. The idea of so tremendous a mass of solid granite as Waterloo Bridge resting on wooden piles is rather a startling one, but they may have originally afforded a fully sufficient foundation. They are beach piles, disposed in rows 3 feet 6 inches from center to center, and combined in a solid mass by a filling-in of rough masonry. Had the river bed undergone no alteration, such a foundation would perhaps have served as long as the bridge above it held together. The river bed, however, has undergone very considerable alteration. Since the bridge was built the stream has deepened under it to the extent of 8 feet. The gravel has been washed away from the piles, and their power of sustaining the mass overhead consequently diminished, and they have sunk under it. Nothing could remedy the subsidence that has already taken place, but Mr. Bazalgette's efforts have been directed to the prevention of further mischief. Dams have been constructed all round each pier dealt with and the water pumped out at half-tide. Enormous blocks of concrete, each weighing from four to five tons, have then been lowered into position round the pier on the bed of the river, so as to constitute an "apron" from 4 to 5½ feet thick, and as hard as the solid rock. This apron slopes outward from the pier at an inclination of 1 in 5.6, and extends 18 feet all round. The outer edge of it reaches to the piles constituting the dam, and which of course run down a great depth into the bed of the stream, where the lower portions of them will be left to constitute a kind of outwork for the defense of the foundation piles should the river still go on deepening. They are massive beams of American rock elm, an intensely hard wood, well suited to this purpose. They are cut off just at the level of the concrete apron, and will no doubt effectually prevent any scouring away of the gravel beneath it. Altogether it looks to be a very neat and effective contrivance for arresting a process which if neglected would undoubtedly eventually bring down Waterloo Bridge in ruins as complete as Macaulay's New Zealander could have desired for his sketch of St. Paul's Cathedral. Mr. William Webster is the contractor, and there are some 90 or 100 men engaged on the work, which from the river bed has a much more serious aspect than when seen from the parapet of the bridge. The middle piers are now under alteration. What will be required for those on the Middlesex side has not yet been determined, no thorough examination having yet been made. Should they have to be dealt with in the same way as the rest, the work will probably be somewhat slower than it has hitherto been, owing to the necessity of keeping a clear way for the steamboat traffic.

LIVERPOOL ENGINEERING SOCIETY.

The fifth meeting of the session was held on Wednesday, the 14th of March, at the Royal Institute, Colquitt Street, Mr. H. Bramall in the chair, when a paper entitled "Wire-rope Traction on Tramways, as Practised in American Cities" was read by Mr. C. F. Findlay, M. A., Assoc. M. Inst. C. E. The author pointed out the reasons why stationery engine systems had universally been disregarded for general railway purposes in favor of locomotives, and described the conditions under which alone the stationery system could successfully compete, the advantage in economy, which resulted when the stationery system could be adopted, the difficulties in the way of its adoption, and how these difficulties had been met first in San Francisco and then in Chicago and other cities. The grip used on the Clay Street Hill Road, the first of the kind constructed (in 1873) was described and a model of it exhibited. The author then went on to give a detailed account of the latest and more extensive application of the system to the tramway lines of the Chicago City Roads Co., which, when the whole system is complete, will embrace nearly fifty miles of tramway, all actuated from one engine-house by ten long, endless cables. Various plans of the works were shown and the result of the experience of the system so far, twenty miles of cable being now at work, were described as being entirely satisfactory and surpassing the expectations of its promoters; burning 630 lbs. of coal per hour, they were doing work which would require 600 horses to be kept.

The engine indicated 115 H. P. when moving the cables of one street 4½ miles in length at the busiest part of the day, there being 43 trains, of two cars each, on the cables and 1,900 passengers (estimated) on board. The line constructed by the Union Passen-

ger Road Co., in Philadelphia, was described, and also the grip used on the rope tramway or railway over the East River Bridge, from New York to Brooklyn. Plans were also shown of the Highgate Hill tramway, now being built in London, from the designs of Mr. James Cleminson, M. Inst. C. E.

A visit of this Society was made to Mr. C. Wells quarry booth on Friday afternoon, March 2d, on the invitation of Mr. Brunton, to see his "Heading Machine for Tunnels" at work. The machine itself was entirely in the heading, so that only a few could get in at a time to see it at work. It is of a somewhat novel principle, as the cutting is done by circular discs set at an angle and revolving or rolling on the face of the rock, in two groups of six, working in sets of three alternately, a revolving motion being also given to the two groups of cutters which are fixed to a cross head revolved at its center. It is capable of cutting two inches an hour, and has been constructed for some waterworks in Australia.

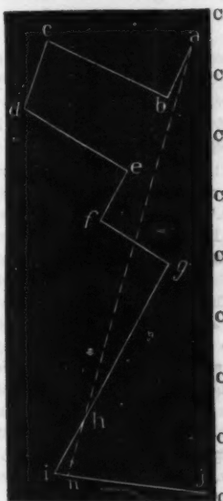
CORRESPONDENCE.

DIVISION OF LANDS.

LONDON, Ont.

EDITOR ENGINEERING NEWS:

Will some of your kind readers formulate a rule by which the following and kindred problems can be wrought? Two farmers have land adjoining, as in the diagram *a b c d e f g h i j*. They agree to draw a straight line from *a* to a point in *i j* so that each will have his original amount with



Courses *a* to *b* S. 30° W. 13.46 chains.

Courses *b* to *c* N. 63° 15′ W. 33.82 chains.

Courses *c* to *d* S. 23° 45′ W. 19.28 chains.

Courses *d* to *e* S. 57° 15′ E. 31.77 chains.

Courses *e* to *f* S. 30° 15′ W. 14.65 chains.

Courses *f* to *g* S. 57° 30′ W. 20.27 chains.

Courses *g* to *h* S. 33° 15′ W. 40.82 chains.

Courses *h* to *i* S. 30° 30′ W. 21.15 chains.

Courses *i* to *j* S. 78° 45′ E.

Scale 40 chains to the inch.

the condition that the parcel *b c d e*, together with that included by the lines *c b* and *d e* produced to the dividing line *a n* is to remain intact with, and form part of, the land on the right of the line *a n*. The undersigned made the survey. Please give this a place in the NEWS. Yours, etc.,

J. ARNETT.

LOWTHROP'S TRUSS BRIDGE.

TRENTON, N. J., March 27, 1883.

EDITOR ENGINEERING NEWS:

Your correspondent, Mr. F. B. Brock, patent attorney, Washington, D. C., professes to give an "Illustrated Historical Description of Expired Patents of Truss Bridges." In his attempt to give that of one of mine, patented June 30, 1857 (for which I received a reissue), he fails utterly, his description being very erroneous. In my patent not a word is said in regard to vibrating posts, and not a word about the upper chords, of which he says: "The upper chords *R* are composed of the caps *e* and the straining rods *n n*;" and of the lower chords he says: "they are composed of the plates *j* connected by bolts *f*, on which the bottom of the vertical posts vibrate." The following I have copied from the patents:

"By the above described mode of connecting the lower chord rods (not plates or flat bars) to the straining plate *B*, the said rods may be readily adjusted, detached, and replaced, may (with the exception of their screw ends) be perfectly plain, *free from eyes*, or slots for receiving keys, and other heavy and expensive forged work, thus enabling me to construct the lower chords of truss frame bridges in a much superior manner (both as regards simplicity of workmanship, lightness of material, strength and portability of parts, and ready connection of the same together) to those constructed in the usual manner."

If Mr. Brock has made as serious mistakes in his remarks upon other patents as he has done in mine, his descriptions are of little value.

Respectfully yours,

F. C. LOWTHROP.

UNCERTAIN DESCRIPTION OF LAND.

EDITOR ENGINEERING NEWS.

The inclosed is plat or copy of grant of a track of land in this State in dispute upon a technicality in the description of the property. The grant calls for a line from the stake at the junction of White Oak and Clear Fork "south with Clear Fork to the beginning." But as the beginning is not actually located on the bank of Clear Fork, the question is, what is the legal construction of the wording of the grant.

One party claims that as the beginning is located in a hollow the waters of which run into Clear Fork, the boundary should follow the river to the mouth of the hollow and thence up the hollow to the beginning. This is admitted to have been the *intention* of the grant.

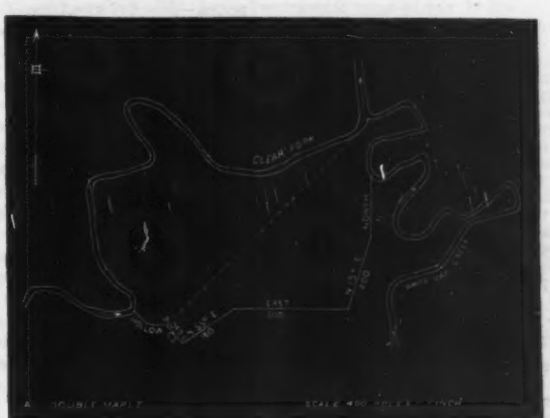
The other party claims that on account of the hollow not being named and Clear Fork not at any point touching the beginning, the boundary of the grant must be a direct line from the junction of White Oak and Clear Fork to the beginning point, as shown by the dotted line on the plat.

Neither of the claims accord with the original description. One assumes a course not mentioned, but following a hollow referred to. The other a course neither "south" nor yet "with Clear Fork."

I should be glad to know your opinion, or that of some of your readers as to how the boundary should be decided. Yours faithfully, D.

COPY OF GRANT.

Beginning at a *double maple in the head of a hollow* about one-half mile east of the Brewster Ford, thence south 45°, east 62 poles to a white oak and pointers; thence north 55° east, 160 poles; thence



due east 300 poles to a double hickory and pointers; thence north 15° east, 200 poles to a hickory and pointers; thence due north to a stake on the bank of White Oak; thence west with the same 520 poles to a stake at the junction of White Oak and Clear Fork; thence *south with Clear Fork to the beginning.*

POWER FROM THE SUN.

From time immemorial attempts have been made to utilize the direct rays of the sun as a motor for industrial purposes. During the last ten years considerable progress has been made by M. Muchot, a professor in the Lyceum of Tours, France, which has arrested the attention of the French and Algerian governments and scientific societies, and Muchot has received from those high authorities golden medals, the decoration of the Legion of Honor, and subscriptions aggregating nearly 100,000 francs.

A company with a larger capital has just been formed in Paris for the purpose of manufacturing the solar machines invented by Prof. Muchot, and over 100 of the various applications are in actual use in different parts of the world, pumping water, cooking food, running small agricultural machines, etc. The apparatus consists of a conical reflector 11½ ft. in diameter, from which the solar rays are reflected upon a boiler 3 ft. long and 16 in. in diameter outside, inclosed in a glass cover, and placed vertically in the axis of the reflector. A battery of four such machines, it is claimed, gives three horse-power, the price of which is, at the shop in Paris, 10,000 francs, or $2,000.

Since our attention was called to the machines in France the information comes that a company composed of some of the best mechanics and engineers of California has been incorporated for the purpose of purchasing American patents for utilizing solar heat for industrial purposes, such as pumping water for irrigating and reclaiming lands, propelling all kinds of machinery, furnishing steam and hot water for canneries, cooking food, the manufacture of borax, distilling alcohol, drying fruit, the sublimation of sulphur, and the roasting of ores.

An examination of the American patents and of the plans of the California company shows that the old style of conical reflectors and vertical boilers has been abandoned, and that the new apparatus, which the company has already commenced to construct, consists essentially in a reflector, cylindrical in form, having a parabolic cross-section, and being straight in longitudinal direction, in combination with a cylindrical heat receiver, or boiler, mounted on the axis of and parallel to the reflector, both reflector and boiler being placed horizontally or nearly so, and provided with suitable devices for setting the machine in proper position and causing it to follow the sun's apparent movement.

It is confidently expected that fully five horse-power will be realized from 7 a. m. to 5 p. m. It has been found that occasional passing clouds have no perceptible effect on the apparatus. All know that the sun generates immense quantities of heat. It has been demonstrated by Ericsson, Muchot and other scientists that the heat of the sun, after absorbtion by our atmosphere, represents rather over one horse-power per square yard, and that we get more heat (other things being equal) on a day in Winter than in Summer, for the sun is nearest to us in our northern Winter by several millions of miles.

There are millions of acres of the finest land in the world in the San Joaquin and other valleys of California and Arizona, which land only needs to be "tickled with water to make it laugh with the harvest." Only a small part of this land can be irrigated by the usual method, but water exists in inexhaustible quantities in most localities at from ten to 100 feet from the surface. By driving a number of tube wells, say fifteen feet apart, and coupling them together at the tops and applying a sun engine, a supply of water can be obtained for irrigation and for cattle which would raise the value of the land from $2 to $5, its present price, to $30 and $60 per acre, and fill these valleys with a prosperous and happy population. This is a phase of the solar engine business which should commend itself to the owners of the large ranches in the interior valleys, where the conditions are most favorable for the development of this enterprise. We are not unmindful of the objection that the solar rays are sometimes interrupted by clouds, and that at best such an engine would be available only in the day time, but we answer that in the summer time, during our rainless season, when their need would be greatest, the sky is seldom obscured by clouds and the power of the engine could be used for compressing air or generating electricity which might be stored, and the electricity or compressed air would serve to run the machinery in the night. In

this way the cities on the plains could also be lighted by electricity at a minimum cost.

The Solar Heat Power Company, of California, to-day filed articles of incorporation in the County Clerk's office, with a capital stock of 100,000 shares of $100 each.—*San Francisco Evening Bulletin.*

FROM THE GULF TO THE ATLANTIC.

An important project for facilitating transportation, which has been under consideration, in one form or another, for fully fifty years, is now likely to be actually carried out. It is that of digging a canal across the Florida peninsula, so as to join the Atlantic and the Gulf of Mexico.

Two different methods of accomplishing the object have been advocated. The first is known as the Florida Ship Canal, to be run from the Suwanee River to the St. John's, and to form a waterway wide enough and deep enough for the passage of ships with full cargoes from the Gulf across the peninsula. The second plan is for a barge canal merely; and this would be less difficult of execution, and would involve a far less cost.

Between New Orleans and the Gulf coast of Florida there is a series of inlets and sounds through which Mississippi River barges can be towed, and if a waterway through Florida was opened they could continue their way to the Atlantic coast, from which their cargoes could be shipped directly to Europe. The great swamps of that State, it is contended, furnish a water level which renders a canal easily practicable. The theory is that they can be connected at comparatively small expense, and thus be made to form a continuous waterway suitable for barge transportation from St. Mark's on the Gulf to St. Mary's on the Atlantic.

In fine the project is to bring the barges of the Mississippi and its tributaries to an Atlantic port at the mouth of the St. Mary's River, with the Georgia town of the same name on the north, and the Florida city of Fernandina on the south. Here is a good and safe harbor, capable of improvement, so that it shall always be deep enough for vessels of the heaviest draught.

This route and this particular canal were strongly favored by Gen. Gillmore in a report to Congress on the subject made in 1880. Such an unbroken channel of communication, he showed, would make St. Mary's the maritime terminus of 30,000 miles of rivers and waterways, teeming with a commerce which was recently valued at five hundred millions annually.

The cost of the whole work, according to the estimates, would not exceed ten millions of dollars, and probably would not be more than seven millions; whereas the ship canal proposed would involve an expenditure of at least fifty millions, the requirements of width and depth in a barge canal, of course, being much less than in the other. The barge canal has another great merit besides comparative cheapness. Its projectors ask nothing from the general government, whereas the ship canal could scarcely be carried through without frequent and large raids on the treasury.

The advantages of enabling the Mississippi barges to be towed directly to an Atlantic port would be many. The very dangerous navigation through the Florida reefs would be avoided. The loss of property because of wrecks along the Florida coast amounts to millions annually. A saving of probably twenty-five per cent. would be made in insurance on account of the new and safer method of communication. The money saving effected, it is anticipated, would be sufficient to pay tolls great enough to make the enterprise moderately profitable, and yet leave a handsome remainder for the shippers.

Of course the railways which now carry products of the Mississippi valley are natural enemies of the canal project, as they are of all water transportation, and the success of this work, if it was half as great as its advocates anticipate, would be especially damaging to them. But the Southern and Western producer would be a substantial gainer on account of it. Competition between land and water transportation would be increased, and the shipper would benefit thereby.

The Legislatures of both Florida and Georgia have lately passed charters empowering the construction of this large canal, and it is now probable that the work will be carried to completion by private enterprise and private capital. If it is accomplished, it will doubtless be of enormous advantage to the region contiguous to the canal, at whose eastern terminus a great Atlantic port will probably be built up. The whole country, too, must profit by any important increase of the facilities for bringing the products of the West to the Atlantic coast for shipment.

The Florida barge canal is therefore a very interesting and significant enterprise.—*N. Y. Sun.*

COUNCIL BLUFFS & NORTHERN R. R.—At a recent meeting held in Council Bluffs, Iowa, articles of incorporation were adopted and directors chosen Capital placed at $1,000,000. The proposed line will run from Council Bluffs to Storm Lake. A corps of engineers will be started from the latter place at once.

CONSTRUCTION ACROSS A LAKE.—The Racket reporter yesterday had the pleasure of meeting Mr. G. B. Nicholson, the civil engineer in charge of this division of the New Orleans & Northea stern Railroad. He says that at present there are eight pile-drivers at work between this city and the north shore of Lake Pontchartrain. Several of the pile-drivers have taken position in the middle of the lake and are hard at work building the bridge. The bridge across the neck of the lake, the contractors say, will be completed within the next four months. In the lake proper there will be sunk several iron cylinders, to act as piers for the draw-bridge. These cylinders, when put in position, will have piles driven inside of them, and then filled with concrete in order to make them as solid as possible. The same kind of piers are now being sunk in the Pearl River, but Mr. Nicholson says that the work is accompanied at present with much difficulty, for the reason that the Pearl River is high and the current so strong that the iron cylinder has to be "guyed" to keep it in position. The manner of sinking the cylinder is as follows: A stream of water is forced down the cylinder, which stirs up the mud. This mud in a dissolved form is pumped out, and thus the cylinder is gradually allowed to sink into position. One of the cylinders of the Pearl River bridge struck a log some distance below the surface of the ground, and to get it out of the way a 200-pound ax was put in a pile driver, and, being hurled down the interior of the cylinder, succeeded in chopping the log in twain. At present the work of building the bridge across the Pearl River is being pushed as rapidly as possible, and the force of men is being increased, for the reason that Mr. John Scott, a few days ago, issued instructions to all employés to push the work ahead at once. The grading of the road from the lake down southward into the city, along People's avenue, has reached a point near Claiborne street. A small portion of this grade work is through very swampy land and the consequence is that willow mattresses are being put down in order to form a false bank for the road until construction trains can haul dirt to make a solid road-bed. On the north shore the trestlework extends about two miles into the lake. Tracks have been laid on the trestle and creosoted lumber is now being hauled by construction trains to supply the pile-drivers. At the creosote works there is quite a town being built called Slidell, and a great deal of land in the vicinity has been bought by speculators. Several houses and stores have been put up lately and town lots are selling at good prices.—*New Orleans Times-Democrat.*

ASPHALT MORTAR.

[Translated from the "Moniteur Industriel."

The *Centralblatt der Barwerwaltung* describes a special composition made at Stargard (Pomerania) which has been employed with success for some years on the Berlin Railway at Stettin for coping walls, and in all cases where a coating impervious to water may be required. This substance is composed of coal-tar, to which is added clay, asphaltum, rosin, litharge and sand. It is in fact a species of artificial asphalt, with this difference, that it is applied cold like a cement. Properly used, it possesses great tenacity, and above all resists perfectly all changes of temperatures.

To use this mortar, the place where it is to be applied is first made perfectly dry and clean, a first layer of hot varnish, with a base of coal-tar, is then applied, and upon this the mortar is spread (cold), with a trowel to a thickness of about half an inch. If the surface to be covered is considerable, a second layer of the hot varnish is applied, and strewn with coarse sand.

In this way a covering is obtained that is perfectly impervious to rain and snow, and which will last indefinitely. We made add that it costs very little.

TUNNEL HOISTING CAGE.

The elevator, or cage, described and illustrated this week, is especially intended for tunnel-shafts; it is cheap and easy of construction, and has been thoroughly tested by a long period of service.

The timber used in this cage was hard yellow pine, and, with the exception of the safety appliance, was built upon the works, by the ordinary blacksmiths and tunnel-carpenters. The detail of framing, general dimensions and arrangement are shown upon the plans given, and need little description, they will explain themselves.

The "guides" in the shaft were simply 4-in.x4-in. Y. P. sticks, planed on three sides, secured by ⅝-in. counter-sunk bolts to a 4-in.x 10-in. timber, as shown on Fig. 4. Cast-iron racks were dispensed with, from motives of economy, and especially from the fact of their known inefficiency; for if, upon the breaking of a hoisting rope, the cage, from any want of exactness in "lining," once gets a sufficient start to break several teeth, the rack is frequently stripped to the bottom. A steel-pointed chisel-arm (Fig. 3) was substituted. The 1½-in. turned pins passing through these arms are so arranged that the entire weight of the cage is suspended from them. The spring, acting against a ¼-in. iron plate extending along the bottom of the cross head-piece is adjusted to just resist the weight of the empty cage, so that so long as the hoisting rope is intact, the vertical part of the chisel-arm lies within the socket in the side frame of the cage; but upon the breaking of the rope the spring is released and will push the horizontal arms down and the chisel-end out in such way as to cut into the 4-in.x4-in. guide. In the cage described this arrangement has proven its efficiency about a half-a-dozen times, and the cage was always brought to a standstill within a maximum of 20 in. fall; in a less distance when the cage was loaded; the 4-in.x4-in. guide would be badly damaged for this distance, but the crippled portion was sawn out and a new piece put in.

"The guides" on the cages, at top, are pieces of 3-in. x 10-in. Y. P. plank, bolted on securely, but in such manner that they can easily be renewed when worn. The bottom guides are different in form, but as quickly replaced.

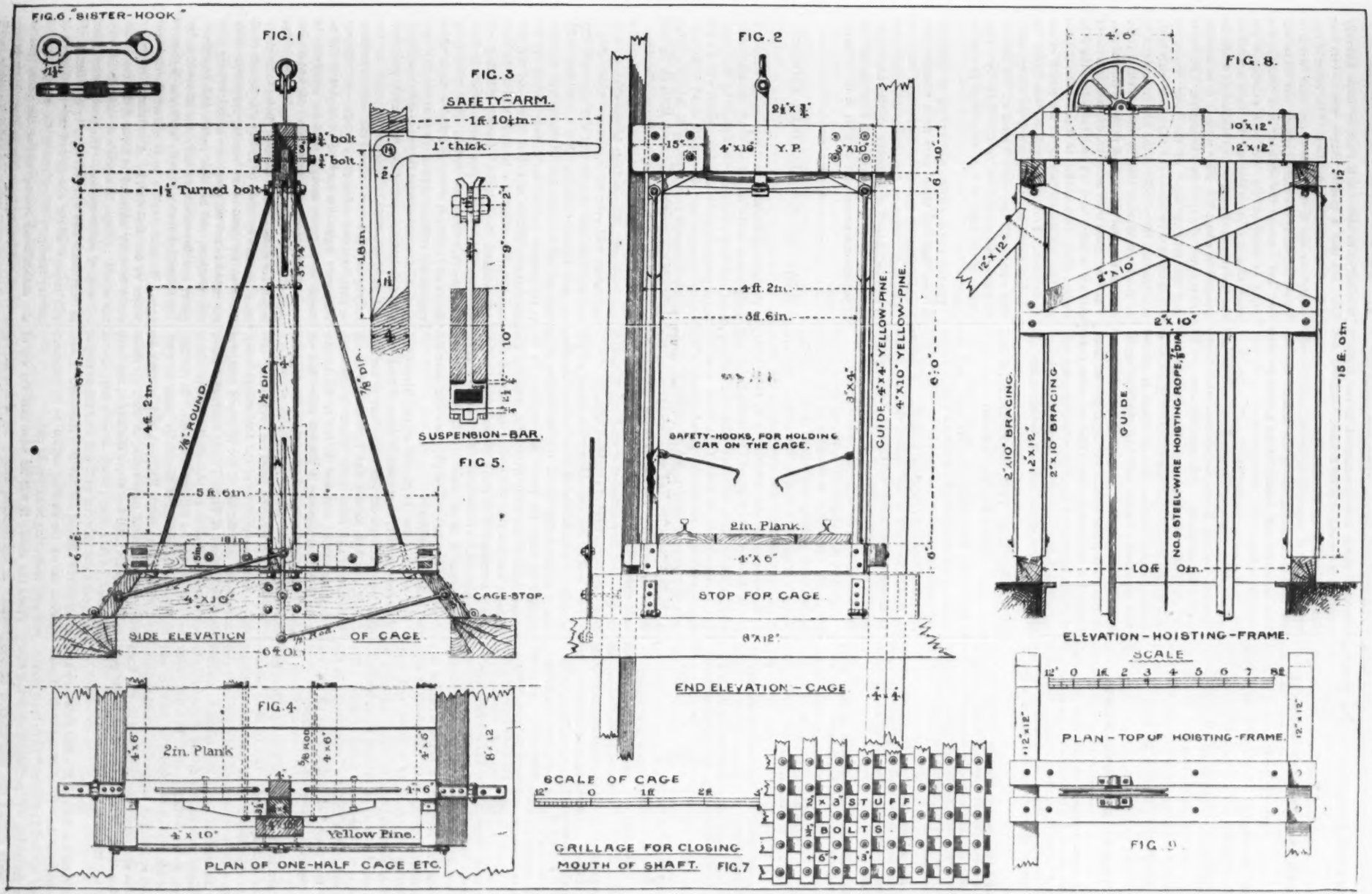
Figs. 1, 2, 4 show the "cage-stop" for holding in adjustment the track on platform with the rails leading to the "dump." This stop consists of two traps made of 3-in. Y. P. plank, hinged to a heavy horizontal timber, and, when down, resting upon two 4x10-in. planks bolted to the outside of the 4-in,x10-in. guide. The distance between these traps when closed was a little less than the length of the cage platform, so that the cage, in ascending, would open them and allow it to pass through; the traps fell back upon the rests, by their own weight, and the cage could then be lowered upon them and the car run off. A double lever on one side of the shaft only, as shown on Fig. 1, enabled the "top-man" to throw the traps back, when the engineer had taken the weight of the cage off of them by hoisting a short distance, and the cage could then be lowered.

Fig. 7 shows an inexpensive but most important appliance, a grillage for closing the mouth of the shaft when the cage is down; the want of this has more than once cost human life, in the experience of the writer. This grillage is made of 2-in.x3-in. stuff, secured by ½-in. bolts. It is long enough to rest upon the two traps, when the cage is down, the hoisting-rope passes through its center, and when the cage ascends, the grillage is carried up by the head-pieces out of the way.

The hoisting-rope in this case was No. 9. steel wire rope, Roebling make, and was secured to the suspension-bar (Figure 5) by a "sister hook," (Figure 6), which was simply a double or split-hook, made more secure when in place by a lashing of twine. The ordinary open hook frequently becomes detached when the cage strikes the bottom of the shafts.

The hoisting-frame (Figures 8, 9) must be adapted to the surrounding conditions—position of engine, dumping-ground, etc. All that is needed is a stout, well-braced frame-work, fastened together with bolts, and not spiked. The frame in height should have a clearance of at least double the height of cage when resting on the "stops;" this is necessary to lessen the danger of breaking the hoisting-rope by "overwinding" at night, or at any time by a careless engineer. The hoisting-drum, or pulley, should be as large in diameter as possible for wire rope. The wheel shown is the ordinary cast-iron one, which is usually furnished by the makers of the hoisting-engine.

On Figure 2 two iron hooks are shown, which are thrust into staples on either side of the frame of the car, when on the cage, and keep the car in position



TUNNEL HOISTING CAGE.

ENGINEERING NEWS

AND

AMERICAN CONTRACT JOURNAL.

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Articles for Publication in the current number should be received at the office of publication not later than Thursday morning, and advertisements not later than Friday noon.

Correspondence upon subjects which naturally belong to the province of this journal is solicited.

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No. 65 OF VAN NOSTRAND'S SCIENCE SERIES is a book of Pocket Logarithms to four places of decimals, including logarithms of numbers, and logarithmic sines and tangents to single minutes; to which is added a table of natural sines, tangents, and cotangents. The handy forms of these tables commend themselves, and for computation in the field the "four places" of decimals are all that are generally required. The price is 50 cents.

THE PLASTERER'S MANUAL, in a revised illustrated edition, has just appeared. The contents include an accurate description of all tools and materials used by the craft, with notes on the appearance and action of the various limes and cements, instructions for making mortar, the details of plastering in all its forms, cistern building, etc. This little work contains, besides the above, forms of contract and useful tables and recipes, suggestions, cautions, etc., to those who are practically interested in the kind of work described. Wm. T. Comstock is the publisher. Price, 75 cents.

PROCEEDINGS AM. SOC. C. E.—The February and March numbers of the "Proceedings of the American Society of Civil Engineers" have been issued. The paper describing "Experiments upon the flow of water made during the construction of the works for conveying the water of Sudbury River to Boston," which was commenced in the January number, is continued in the February number, and finished in that of March. We have remarked upon this set of experiments before, and can only add that the space given to the minute description of means and results by no means detracts from its value.

NEW CROSS-SECTION RECORD-BOOK.—Keuffel & Esser, of this city, have just published a new Cross-Section Record-Book. It is especially intended for the use of Division Engineers. The book is large quarto, 12½x10½ inches, and is substantially bound in leather-covered boards. The title-page is printed with appropriate blanks, and the contents are as follows: 8 blank pages for a general map, 160 pages cross-section paper (10x10 to the inch), 32 blank pages for memoranda, etc., eight or more pages of profile paper plate B. The advantages and conveniences of this book are too manifest to need explanation. For price, inquire of the above firm.

THE FUTURE OF THE MISSISSIPPI IN REGARD TO ITS OUTLET.

THE lower Mississippi, ever eccentric, and uncertain in its meanderings toward the gulf, is giving just cause for alarm to the people of New Orleans and the lowlands of Louisiana generally. It threatens to seek for itself a new outlet, via., the Bayou Atchafalaya, and leave the Cresent City and the Sugar Coast far inland, cut off entirely from the vast commerce of the upper rivers and the sea.

Capt. Jas. B. Eads, in his testimony given before the House Committee in Washington, on January 23d, seeks to awaken the public to the vital importance of speedy action in this matter. The evidence submitted by the engineers of the Miss. River Commission, and referred to by Capt. Eads, proves the threatened danger to be imminent, and ever increasing, at a rate that allows no dallying. The eroding teeth of one of the most powerful elements in nature are rapidly gnawing away at the sill of soft alluvial earth that now stretches across the upper Atchafalaya, and are as speedily reducing the difference in depth of bed between this and the main river. Each flood takes out a deeper bite and brings nearer the realization of what can be looked upon only in the light of a national calamity.

If we look at the map of lower Louisiana, we will see that the Atchafalaya lies in the general southern axis of the Mississippi River. It is the shortest cut to the gulf by about 125 miles, as compared to the present route of the main river; and tradition has it that it was one time *the* outlet, that Grand lake is only a remnant of its past bulk and state; and, in some past age, for reasons that are even now working to relegate it to its ancient bed, the river was diverted to the east, and sought a new and more distant outlet at the Balize.

The report of the Engineers of the River Com. of November, 1881, shows that in times of flood one-sixth, or over 16 per cent. of the volume of the Mississippi, was then passing out through the Bayou Atchafalaya; and more recent charts of the same Commission prove that now the loss of flood-water at the Red River Landing is 550,000 cubic feet per second, or over forty per cent. of the entire flood discharge of the main river.

We have just received from an engineering correspondent cross-sections of the Atchafalaya River, made at and near the site of the proposed bridge of the New Orleans & Texas Pacific Railroad. These sections exhibit most graphically the erosive action on the river-bed for the past few years. In the time elapsing between a set of soundings made in 1862, by the Louisiana Central Railroad, and another set taken by the present corporation in 1882, the river-bed, at a point 1,000 feet above the bridge, has been deepened, on an average, nearly seventy feet; and at the bridge site between 1877 and 1882 fifteen feet of easily moved alluvial soil has been removed. Investigation shows the wearing action to be constant, and ever increasing in its yearly ratio.

From the above it will be seen that the cry of "wolf" is not actuated merely by a fear of the future efficiency of the levees at the mouth of the Mississippi at the South Pass, as some unkindly hint; but that a greater danger, may be very near at hand, is actually impending. The effect of this yearly decrease in the value of the main river is to lessen constantly the volume of flow over the present bed, and increase the shoaling and diminish the depth of water on the bars now existing in the river, as well as at its mouth. We have referred to the fact that the length of the Mississippi would be lessened by about 125 miles were it to be emptied into the gulf by way of the Atchafalaya. This means that the present slope of the river would be increased in proportion, and that once fairly in its new channel, the velocity of the new river would be so much augmented that no human effort could stem the tide and turn it back to its old-time course.

As Capt. Eads truly remarks, the matter is one of national concern, and no problem before the Mississippi River Commission is of more vital importance than the speedy closing of the mouth of the Atchafalaya. From an engineering standpoint, the accomplishment of this end is difficult enough now; time wasted will only make it more so. The like has been done before, and can be done again by the engineers of the land, if it is only taken in hand *in time*.

The late and disastrous floods along the Mississippi prove that our water-ways need attention, and nowhere more so than in the flat lands of the lower Mississippi. Waste of flood-water there means loss of velocity, deposit of sediment, and the consequent raising of the river-bed, with all its attending evils of insufficient levees and disaster to the adjacent lands.

A SURVEY OF OUR INDUSTRIAL PROGRESS.

The railroad problem, as it is generally termed, is being almost daily solved at every country cross-road, and it is receiving "solutions" by the newspaper press, magazines, and pamphlets with a vigor which indicates that the public mind is at least greatly interested and in no small degree agitated over it. Some of the so-called solutions, in fact most of them, are interesting reading to railroad men, and afford some amusement for their leisure hours, if they have any. The problem is one which no state legislature will ever solve, and one which even a national legislature should and will approach with no small degree of caution. It is a problem which does not call for a solution at the present time and in the present state of our railway system the less legislation which we have just now, and for, perhaps, years to come, the better it will be for both railroads and the people. Careful thinking railway men and writers upon questions of this kind perceive that there are certain great underlying forces and agents at work, and that to them rather than to any artificial legislative methods that may be devised, however wise they may seem to be, must be left at last the work of ascertaining the real, final, and practical solution. Neither the people nor the railway managers comprehend the railway problem in all its vastness and in all its details, and whatever temporary legislation may be attempted it will be found to be futile though, perhaps, modifying in some slight degree some few of the evils which have grown out of the rapidly growing system. The legislative clothes which we may desire to fit nicely upon the railway infant of to-day will be out of all fitness to the giant of its coming maturity. Both the railroads and the people are in their infancy as to this problem, and as time passes and experience grows and observation expands, the efforts of to-day will be smilled upon as utterly inefficient legislative toys. We must await a more mature development before we can deal with it. A volume of reasoning could be easily adduced in favor of this conclusion but would, perhaps, be a waste of words in the present state of public opinion. The public must learn as individuals and will best learn by experience. It will require all the energy and the intelligence of railway managers to not arouse the antagonism of the anti-railroad feeling and at the same time to prevent this feeling from doing serious harm before the proper time has come for applying such

remedies as experience and intelligence will ascertain to be fit and proper.

One of the factors in this problem is the competition of water-lines. The development of competition between rail and water-lines is yet too insignificant to justify broad generalizations. The Welland Canal, the St. Lawrence system, the lakes, the Erie Canal, the projected canal around the falls of Niagara, the projected Hennepin Canal, the Fox River improvement, the Mississippi River improvements in all their variety, with its resulting barge system, the projected network of canals throughout the Southern States to connect the south Atlantic coast and Gulf ports with the interior and Northwest, the James River Canal, the projected canals in Florida, the projected canal in Delaware, the improvement of the Ohio—these and a score of other projected improvements of our inland water-ways will have a bearing upon the great railway problem.

If, when all these inland water facilities have been completed (should they ever be completed) they will vastly increase the facilities for domestic and foreign commerce and will certainly exercise a very important influence upon the competing railway system. But, on the other hand, the very important factor must not be lost sight of that, as fast as facilities for production are created capacity for consumption expands; and it is not at all improbable that no matter to what extent facilities for transportation may be supplied, there will be a demand for them. It may be represented that the transportation capacity of a water-line is unlimited, and, therefore, the question of competition which such water-lines can or may offer will, therefore, create such an intense competition with rail lines as to very seriously interfere with the earning of satisfactory dividends. To this is can only be replied that past experience shows that water-lines cannot be operated any distance sufficiently long to effect thorough freight rates materially, and that the chief influence of water-lines is in local tariff, and their usefulness will be found mainly in enabling shippers of products to enjoy the benefits of active competition for short distances only. Be that as it may, the railroad system has this problem, this competition, this factor to face sooner or later. It is destined to present itself with all the vigor which the anti-railroad spirit can impart to it. It is quite probable that this spirit will find that the pet legislative schemes now under consideration will be inefficient, that the railroads will still maintain and exercise their power, that the efforts of legislatures will be found to be impracticable, and that, as an out-growth, or as an offset to this disappointment schemes will be inaugurated and rushed through state and national legislatures to offset the railroad system by a complete network of inland water-ways. A least circumstances point to this as the probable solution of the railway problem. And if such should be the course of events, the railways need have nothing to fear, because the water-ways will be subsidiary to them, will become feeders to them, and will make it possible for a population far in excess of the present to find easy subsistence throughout all the vast interior of the country by reason of the expansion of such an inland system. In fact, the building of an inland water system will do more to develop and strengthen and expand the railway system of the future than any other single agency. The great fault, if fault there is, is that towns and villages are now too far apart, the country through which railroads pass not sufficiently populated and cultivated, and traffic too light. If an inland water-way system could increase the agricultural area, could lead to the greater filling up of the sections through which the lines would be extended, it would create a greater surplus of wealth for exchange.

The success of the St. Lawrence system of canals will stimulate the construction of inland water-lines in the United States. That line covers 2,382 miles, extending from the Straits of Belle Isle to Duluth. The canals from Montreal to Lake Ontario will be increased some day from 9 feet to 14 feet. The enlarged Welland Canal now carries 12 feet. The Canadian authorities are alive to the importance of rendering this canal of the greatest possible utility, and its competition has led to the discussion of the inland water system in our own commercial circles. In order to secure the further benefits of canal, three lines have been recently surveyed from a point of the Illinois River near Hennepin to the Mississippi. The proposition is to make the canal and feeder 80 feet wide on the water-line, 7 feet deep; locks, 170 feet long, and 30 feet wide. The length of the route is 65 miles. The Marais d'Osier will cost $5,811,367; the Watertown route, $7,207,646; the Rock Island route will cost $6,617,890; a feeder from Rock River, to be 37 miles long, will cost $1,664,117; the enlargement of the Illinois and Michigan Canal, 96 miles long, with 16 locks, will cost $2,298,919; cost of maintenance and repairs for entire line per annum $328,927, and for dredges $108,000. This cost, divided over the immense tonnage that would pass through this line, would reduce the per ton charges to nominal limits, and confer, according to the estimates of the sanguine projectors of this canal, immeasurable benefits to the producing and shipping interests of the Northwest and the consuming interests of the East.

The iron trade has been at a stand still since the opening of the year until within two weeks. Last week closed under favorable conditions, but with manufacturers somewhat appprehensive as to the probable results of the then pending tariff legislation. The expectation was indulged in by the iron interests throughout the country that the recommendations of the Tariff Commission would be quietly accepted by Congress, and that legislation would be enacted in accordance with the commissioners' report. As their report was in the main satisfactory to producers the iron trade felt no perceptable change from the conditions which had surrounded it during the last six months of 1882. When the commissioners' report came up for discu - sion it soon became evident that a bitter fight was at hand, and manufacturers and buyers began at once to guard themselves against possible unfavorable results. As the contest between the friends of high and low duties grew in interest producers became more cautious and buyers deferred heavy transactions until legislation could be determined upon, and hence trade assumed the retail character which has been continued almost up to the present hour. Prices gradually weakened, and they have not yet recovered. The production of pig-iron in the United States in 1882 was 5,178,122 net tons. For 1881, 4,641,564 net tones, and for 1880 4,295,414 net tons. The ratio of increase during these years was as 42, 46, 51. The production of charcoal iron during these three years, beginning with 1880, 537,558, 638,-838, 697,906. The production of iron made of bituminous coal and coke for same three years increased from 1,950,205, 2,268,264, 2,438,078 tons. The production of anthracite iron increased in the same years from 1,807,651, in 1880; 1,734,462, in 1881; 2,042,148 tons in 1882. Jan. 1st, 1881, there were 456,658 tons on hand. Jan. 1st, 1882, 240,896 tons. Jan. 1st 1883, 429,694 tons. The stocks in Pennsylvania, for same dates, were as follows: 164,238 tons, 73,424 tons, 150,-858 tons. The increase during the past three months has been greater than for the same time for several years. This increase was due, as stated, to tariff agitations, to the general expanding of productive capacity and to the uncertainty which consumers felt as to the steadiness of future demand. A settlement of tariff legislation has permitted consumptive requirements to be presented. The iron trade foresees the possibility of overproduction, and is guarding against it. Profits have been reduced to narrower than ordinary limits, and there is less attraction for new investments than heretofore. Various economies are being devised, and the struggle is now in the direction of the cheapest possible production. The industry is expanding throughout the West and the South, and fresh sources of supply are springing up in sections which heretofore depended upon Pennsylvania for production. The tariff reductions are too slight to very seriously affect the iron interests, although it is safe to suppose that imports for July 1st will increase, and this will intensify the already growing competition between American makers. The cost of delivering Southern irons to market is checking the development of valuable Southern coal and ore fields. The iron industry will expand in the South in proportion as the local Southern demand grows; but so far as it depends upon selling iron in Northern markets, its growth will be slow, because of the great cost of carrying products from iron centers to markets in the Ohio Valley. The ore producers of the Lake Superior region have refused to concede to buyers, and prices will be fixed at from 50 cents to $1 less than prevailed last year. The causes at work will increase the supply, not only of Lake Superior ores, but also the supply of less valuable ores in several other sections of the country. The result will be in another twelve months to place consumers of ores in a far better position than they now enjoy. High-priced ore, high freights, high-priced fuel, and high-priced labor are said to stand in the way of the rapid development of the American iron trade. But this inference is scarcely a fair one when the statistics of the trade for the past four years are studied. The development of the Northern and Southern coal fields has an important bearing upon the iron interests. At no time in our history has there been as much enterprise in this direction. Railroads are being built into and through rich mineral sections both North and South, and purchases are being made almost daily of large and small tracts, and capital is being applied with exceptional vigor to the development of mineral resources. The capacity to supply coal will be increased possibly as much as 25 per cent. this year, but the supply will be restricted by the demand. The anthracite coal field is under excellent control so far as producers are concerned, and consuming interests utter frequent complaints against this control, which in a measure restricts the operation of the law of supply and demand and makes iron cost more than it otherwise would. But, after all, no combination, it may be said, can be permanently maintained which perpetrates actual injustice upon consuming interests. The central and western coal fields of Pennsylvania are being very rapidly developed, and a large number of new mines will be sending coal to market within a few weeks over lines of road now being completed. Like activity prevails in the South and West. Improved devices for mining coal are being introduced in several localities to advantage, and it is likely that coal-mining machinery will gradually be introduced to a degree which will enable operators to maintain their position in the labor market to better advantage than they have heretofore. New fields have recently been opened in Kentucky, Illinois, Missouri, and some other Western and Southern States. Discoveries of anthracite coal have been made in the West and in the Southwest which, according to present information, seem to be of a quality and character that will meet the demands of consumers in markets too remote from Eastern coal fields to be supplied. The discovery of such mineral bodies will do much to still further diversify our industries and open up markets for manufactured products of the East.

All of the agencies at work in the development of our industries are of a healthful character. The prime factor underlying them is the assured ultimate expansion of railway construction, and that, as elsewhere remarked, is a problem concerning which nothing definite can be stated in advance. Investors are proceeding with unusual caution and measuring their enterprise with prudence. Capitalists are disposed now to wait until consumptive demand expands to greater dimensions, and creates a greater volume of requirements than appear to be in sight at this date. In other words, the producing capacity is to nearly equal the consumptive capacity to justify the same extraordinary expenditure of money in new enterprises as prevailed during 1881 and 1882.

The declining tendency in prices in iron, steel, coal, hardware, and in all the great raw staples of the country, is a favorable, rather than an unfavorable indication. Low prices necessarily precede activity. The low panic prices of 1877, and the low cost of labor resulting from industrial depression inaugurated in 1873, was the forerunner of the industrial revival which was inaugurated in 1878, and

the low prices now prevailing may with safety be said to be productive of influences which will continue the activity in industrial channels which has been maintained with so much vigor for three years past.

Engineering talent has done much to encourage the investment of capital and stimulate new enterprises. It has pointed out how railways can be built with economy. It has worked out problems in the manufacturing of iron and steel, the success of which has reduced metallurgy to an exact science. It has enabled the miner to delve into the bowels of the earth and dig out wealth by the millions; it has brought the population of the United States within hailing distance of each other; it has overcome obstacles and removed difficulties which obstructed the development of our industries in innumerable ways, and has removed many unpleasant features from a host of avocations, making labor attractive where before it was drudgery; it has opened the arcana of Nature's secrets and spread them before the world; it has attracted capital into investments in a thousand new directions, and led labor by the millions into avenues of employment which, but for it, would remain undeveloped. It has, in fact, been the great pioneer whose intelligence, energy, fidelity, and patience has solved innumerable and difficult problems, and has paved the way for the progression and expansion in material and intellectual directions. It has thrown its illuminations onto the pathway of progress, along which humanity is traveling toward a higher and more perfect development, thus doing a work which but for it would remain undone, and which, but for it, the civilization of the nineteenth century to-day in all its magnificence would be impossible.

The engineer is the pioneer of the great coming civilization. His work must precede all other agencies, and his efforts must open the gate through which skill, capital, labor, and all the energizing factors of our civilization must enter.

The progress we have made is nothing more than the toddling footsteps of an infant. The manhood of the American people is yet to come. The problem of Republicanism has not yet been solved. Republican institutions have not yet accomplished their great purpose; nor will they until the civilization in which we live is looked upon but as the early dawn of what is to come. A host of problems are coming up, for the consideration and solution of which the engineer is laying foundations, broad and deep and strong. These problems scarcely appear upon the surface. They are connected particularly with the intellectual and moral advancement of the American people. The evils and the wrongs which have held society in slavery for centuries will be removed, not by violence, but by the gradual development of intelligence and moral power, and by the expansion of our intellectual capabilities. The United States has a wonderful problem to solve, in which the future of the human race is interested. It will open up opportunities which will in their outworkings favorably affect the conditions of the people of the entire world. To-day we are considering whether we have not reached the probable limit of our development. Ten, twenty years hence we will smile at our limited conceptions of the grand future before us. A half-a-dozen trans-continental lines, a dozen trunk lines, 100,000 miles of railroad, 53,000,000 population is a mere start. The productiveness of the American continent is vastly beyond the productiveness which has thus far been attained. The consuming capacity of the people has not been provided for except to the mere limits of subsistence. There is room for vast improvement; for a vast increase in consuming capacity. There is room for a vast increase in railway mileage, and for a vast multiplication of productive facilities in every direction in which human activities can exercise themselves. The necessities of the people are expanding year by year. What would suffice the standard of requirements twenty-five years ago would not suffice it to-day. The luxuries of to-day will ten years hence be considered as the scantiest subsistence. The necessities of the people will expand as the growth of wealth. This fact will determine the progress of our industries, the development of commerce, the growth of enterprise, the expansion of agriculture, and will point out the limits and the extent of the great highway into which engineering talent will lead the productive industries and the commercial agencies, who are but the factors of the civilization which is transforming the human race.

PERSONAL.

MR. O. D. LEISENRING has been appointed chief engineer of the Connotton Valley Railway, vice MR. WYNDHAM C. JONES, resigned.

W. V. MCCRACKEN resigns the superintendency of the East Tennessee, Virginia, and Georgia Railroad to become assistant-president.

MR. E. H. PHELPS has been appointed Chief Engineer of the Michigan Central Railroad Company. Headquarters at Detroit, Mich.

MAURICE KINGSLEY, a son of the late Canon Charles Kingsley, is working in the office of the city engineer of Buffalo, N. Y. It is said that he has inherited not a little of his father's literary talent.

CITY OF MEXICO, March 29.—Mr. JOHN SCULLIN, of St. Louis, General Manager, and Mr. R. C. PEEBLES, late of the Pennsylvania Railroad, Superintendent of the Mexican National Railroad, have resigned their positions.

MR. SALITA, lately chief of the works on the Panama Canal, will soon arrive in New York to take supreme charge of the Canal Company's interest in the United States. He will be accompanied by Mr. Boyard as his secretary.

GEORGE M. SHATTUCK having resigned the position of superintendent of the Texas division of the Texas Continental Transportation Company, MR. CHARLES A. HASLETT, formerly of the Kentucky Central Railroad, has been appointed to the position. MR. HASLETT is an old railroad man, experienced, popular, and well qualified to give satisfaction. His headquarters will be at Houston.

MAJOR FRANKLIN HARWOOD, of the United States Corps of Engineers, died in Boston on the 26th. He was a native of Rhode Island and was appointed to a cadetship in the United States Military Academy in 1856. Graduated in 1861, he was commissioned as Second Lieutenant in the Third Artillery, in which he served as Second and First Lieutenant until July, 1862, when he was transferred to the Topographical Engineers. In March, 1863, he was transferred to the Engineer Corps. Promoted to a captaincy June 5, 1863, he was brevetted Major Aug. 1, 1864, for gallant and meritorious services during the campaign before Richmond. He received a further brevet promotion April 9, 1865, to the rank of Lieutenant-Colonel for faithful and meritorious services during the operations resulting in the fall of Richmond and the surrender of the insurgent army under General R. E. Lee. Since the close of the war Major Harwood has been engaged in a number of engineering duties, and at the time of his death was connected with the topographical survey on this coast. He was promoted to be Major Feb. 22, 1869.

ELECTIONS AND APPOINTMENTS.

E. E. DWIGHT, superintendent of the Western Div. of the "Nickel Plate," it is said, has been appointed General Manager of the Toledo, Cin., and St. Louis R. R.

NEWPORT AND CINCINNATI BRIDGE COMPANY.—The Board of Directors of the Newport and Cincinnati Bridge Company elected at Cincinnati, on March 21, Thomas D. Messler, president; A. S. Berry, vice-president; S. B. Liggett, secretary; Mr. Davidson, of Pittsburgh, treasurer. A dividend of 3 per cent. was declared, payable April 1.

ELECTRICAL ENGINEERING AT CORNELL.—ITHACA, N. Y., March 26.—The Trustees of Cornell University at their meeting to-day authorized the establishment of a course in electrical engineering on the opening of the new physicial and chemical laboratories in September next. A very extensive collection of apparatus has been received for the purpose.

BOSTON WATER-WORKS.

Canvass of bids for cast iron water pipes received March 20, 1883:

Contract	Size.	Quantity.	A. H. McNeal, Burlington, N. J.	R. D. Wood & Co., Philadelphia, Pa.	Warren Foundry & Machine Co., Phillipsburg, N. J.	Mellert Foundry & Machine Co., Reading, Pa.	Glocester Iron Works, Gloucester Cy, N. J.
		PRICE PER TON OF 2,240 LBS.					
Contract.	16 inch, Class A	60 tons	$38.00	$36.80	$36.71	$37.50	.....
	12 " " B	600 "	38.00	36.80	36.71	37.50	.....
	8 " " B	370 "	38.50	36.80	36.71	37.50	.....
	6 " " B	300 "	38.50	36.80	36.71	37.50	.....
	4 " " B	30 "	40.50	36.80	36.71	37.50	.....
	Special castings	80 "	70.00	36.80	36.71	70.00	.....
			$57,690.00	*$52,992.00	$55,525.60	$56,600.00	.....
New Main Contract.	48 inch, Class A	590 tons	$36.00	40.60	35.59	36.50	37.91
	30 " " A	90 "	36.50	40.60	35.59	36.50	37.91
	24 " " A	420 "	36.50	40.60	35.59	36.50	37.91
	Special castings	150 "	70.00	40.60	86.80	75.00	97.50
			*$48,915.00	$49,120.00	$50,745.40	$40,940.00	$54,809.60

* Awarded to.

THE PANAMA CANAL.

[Translated from Bulletin du Canal Interoceanique.]

PANAMA, March 2.—The dredging and excavation at Colon is actively going on; new works have been opened at Bohio-Soldado, San-Pablo, and Matachin; the machines are approaching La Culebra (the highest point of the Isthmus); six thousand laborers are at work, health good; activity everywhere. (Signed) Ch.—Aimé de Lesseps.

The engineers of the company are now testing a new dredging machine, made at Renfrew, on the Clyde (Scotland). It is modeled after those used so successfully at Port-Said; it is provided with two compound engines of 250 horse-power each, with a marine boiler. The hull is about 170 ft. long, 29 ft. wide, and 12 ft. depth of hold. One of the engines is connected with a screw propeller, which enables a speed of seven knots to be attained.

The contract test commenced on Feb. 27; notwithstanding the limited space in which it had to work, which necessitated a return to the starting point with every advance of 30 ft. the work done in eight consecutive hours, in a depth of water varying from 18 to 35 ft., was 200 cubic yards per hour. The dredge will be soon rigged, provisioned and ready for the voyage across the ocean to Colon.

A STANDARD MERIDIAN.

OTTAWA, March 15.—A return, consisting of a copy of the memorial addressed to the Governor-General from the Royal Society of Canada and the Canadian Institute of Toronto relative to a representation of Canada in the international conference to determine a standard meridian, now contemplated by the congress of the United States, was laid on the table of the Senate to day. The memorial of the Royal Society is dated Jan. 15, and recites that "for some years back the general regulation of time for railway, telegraph, scientific and ordinary civil purposes has engaged the attention of societies and individuals in the Dominion and elsewhere. Geographical circumstances, rapid settlement over wide expanses of country and the extraordinary development of railway enterprise, invest the subject with special interest to the inhabitants of the Western Continent. An earnest movement to reform our general time

system has commenced, and the importance of the question is generally recognized by the public. The first great step in the movement is to adopt a common zero as a standard for reckoning time, and in order to promote international convenience and ultimately secure uniformity of system generally, it is deemed expedient to establish a zero which would correspond with an initial meridian common to all nations for computing longitude. The question has been discussed by the Royal Society, and at a meeting in May last it was announced that the President of the United States would call a conference to fix on and recommend for universal adoption a common prime meridian to be used in the reckoning of longitude and the regulation of time throughout the world. On Aug. 3 a joint resolution in its favor passed Congress, and on Dec. 5 the President of the United States informed Congress that he had directed communications to be sent to the foreign Governments. While Canada is not in direct diplomatic relations with the United States, no country is more deeply interested in the question, and the Governor-General is therefore asked to use his offices in having the Dominion represented."

The memorial of the Canadian Institute of Toronto is dated May, 1879, and accompanying it is a paper, read by Sanford Fleming before that body in February of that year. The copy of this paper was forwarded to the Royal Society of Great Britain. A reply was received from the Secretary which says with regard to Fleming's proposals for the establishment of a system of cosmopolitan time, with plans for a ready passage from this to approximate local time, that the means suggested by the author are simple and seem well devised. The difficulty was to induce different civilized nations to concur in the scheme. Strong reasons have been adduced by the author why a meridian passing through Behring Strait, or nearly so, should be chosen. A meridian 180° from that of Greenwich fulfills this condition, and if this were adopted a change in existing maps which refer to the meridian of Greenwich as the prime meridian would not be serious. The choice, however, of a prime meridian even to the extent of adopting one exactly 180° from a meridian at present in use is one upon which the susceptibilities of individual nations might make it more difficult to obtain currency than upon mere adoption of a common system of cosmopolitan time reckoning in the abstract.

Communications from the Imperial Academy of Sciences and a work on the subject transmitted by the British Minister at Madrid, with a further memorial from the Canadian Institute, dated Toronto, March, 1883, close the correspondence.

BOSTON IMPROVED SEWERAGE.

Canvass of bids received for building outlet sewer at Moon Island. The work comprises a double sewer of brick and concrete masonry about 600 feet in length, with a cut stone pier head at the sea end of said sewer.

BIDDERS.	A. 1,150 lbs. ft. coffer dam.	B. 5,000 cu. yds. earth excavation.	C. 4,250 cu. yds. borrowed earth.	D. 10 cu. yds rock excavation.	E. 3,300 cu. yds. ballast.	F. 6,950 tons rip-rap.	G. 3,000 cu. yds. concrete.	H. 850 cu. yds. brick mas., American cement.	I. 450 cu. yds. brick mas., Portland cement.	J. 133 cu. yds. rubble masonry.	K. 990 cu. yds. dimen. masonry.	L. 10 M. ft. b. m., spruce lumber.	M. 170 spruce piles.	TOTALS.
	$	$	$	$	$	$	$	$	$	$	$	$	$	$
Boynton Brothers, Boston	14.00	0.75	0.60	3.00	2.00	2.25	8.00	14.00	16.00	10.00	45.00	30.00	5.00	102,397.50
W. H. Ward, Lowell	16.00	0.75	1.00	3.00	2.30	2.30	7.00	16.00	18.00	9.00	30.00	30.00	8.00	103,812.00
John A. Gill, Boston	19.50	0.60	0.60	5.00	1.50	1.50	5.50	12.75	13.75	6.00	60.00	22.00	5.00	94,753.00
Henry H. Pike, Cambridge	14.50	0.97	0 95	6.00	2.86	1.65	5.95	14.37	16.56	9.50	40.00	28.00	5.98	97,586.60
Trumbull & Cheney, Lawrence and Chelsea	22.09	1.21	1.02	3.00	1.56	1.50	7.36	17.06	19.46	9.48	39.30	37.20	5.60	110,258.34
James H. Kelley, Malden	13 99	0.55	0.62	5.00	1.42	1.48	5.40	14 25	16.25	7.50	38.00	30.00	4.50	84,393.00
Wm. H. Cavanagh, South Boston	45 00	1.10	1.10	10.00	1.65	1.65	8.00	18.00	20 00	10.00	40.00	40.00	6.00	141,047.50
C. W. Parker & Co., Boston	31.97	0.75	0.90	10.00	1.47	1.60	6.00	14.75	17.00	9.00	41.30	40.30	8 00	112,666.00
Arthur F. Williams, Charlestown	12.50	1.25	0.75	3.00	1.60	1.50	6.50	15.25	17.00	8.00	40.00	28.00	4.00	92,840.00

THE CARD CATALOGUE AS AN INDEX FOR NOTES, MEMORANDA, ETC.

The preface to the first edition of that excellent little book, Molesworth's Pocket-book of Engineering Formulæ, opens with the following sentence: "Few are gifted with a memory so retentive as not to require the aid of written formulæ in working out the numerous calculations constantly necessary in the profession of an engineer."

A similar remark might be made of men engaged in almost any other occupation, excepting that the data required by most persons engaged in the conduct of business, in scientific or other investigations, can rarely be condensed into mathematical formulæ. The universality of memorandum books, though, indicates a general need of some form of supplemental memory. While these answer very well for merely temporary purposes, the difficulty of finding what is needed when the number of books or memoranda becomes multiplied, and the recollection of what they contain is faded, is so great as to make their contents almost useless.

It is also often desirable to preserve articles found in the newspapers and other fugitive forms of literature. The inevitable scrap-book, which most persons at some time of life begin, and few continue, is resorted to for the preservation of such material. But even if this plan is not abandoned, the scraps accumulate so rapidly that in a short time, if they are not indexed, they become next to useless, for the same reason that memoranda do when their number increases. As a matter of fact, the time and labor required to put newspaper cuttings in a scrap-book, and of then indexing them, is so great that only a very few can spare the one or have the patience and industry for the other. The consequence is that stranded scrap-books are among the most common articles of garrets and closets, and most people conclude quite early in life that the time required to keep them can be more profitably occupied in other ways.

Besides the preservation of such clippings, it happens often, in reading books, periodicals and publications and documents of various kinds which cannot be mutilated, or in intercourse with persons or by observation, that we find information which is quite certain to be needed in future. Unless some note is made of the place where it may be found, it may have passed quite beyond the reach of memory or of search when it is required. Therefore notes of reference, indicating where to look for the records of such knowledge, will have great value; but, like other material of this kind, unless it is classified or indexed in some way it is useless when wanted.

Few perhaps realize how much valuable information may be accumulated if once the habit is formed of making notes of whatever is likely to prove of value. The store of data grows like the accumulation of "papers" in a busy man's pocket or on his desk. If all such knowledge is promptly classified it becomes like a well-organized and drilled army. Each item falls into its place, and any part or the whole can be called for or moved at will. Without such organization our notes and data are like a mob, incapable of obeying our orders or wishes. Of course the kind of material which a person will think it desirable to preserve, or the subjects and occasions on which he will make notes, will depend on his age, tastes, interests, duties, occupation and experience. The erasures, in memorandum books show, however, to use simile of the army again, that a good many of our facts become disabled, and require to be discharged. New recruits must be constantly added, and the organization must be of such a character that one or more individuals may be taken from or added to the ranks without in any way impairing its efficiency. If notes and memoranda and scraps are recorded in books, the result is that they soon include an immense amount of rubbish which for various reasons becomes obsolete or useless to the collection, and which it is therefore desirable to destroy, but which cannot readily be detached from the book, and if it could be would leave a blank.

Notwithstanding these difficulties, nearly all persons find it essential to keep notes, memoranda and scraps, the usefulness of which is, though, very far from being as great as it might be if some thorough system were employed for organizing, classifying and indexing data of the kind.

Few have so much occasion to make and to use notes, references, etc., as railroad officers and engineers. Their notebooks may, and often do, become a kind of inanimate second self, a material memory, a rescuer in doubt, a storehouse of knowledge, and to some extent an epitome of what they have learned, much of which may be forgotten. In his memorial address on Mr. Holley, Mr. Raymond described the systematic method which Mr. Holley employed early in life and continued to the end, of making notes of all useful matters coming under his observation. All these notes and his papers were completely indexed, and this practice was an effective means leading to his remarkable success, wonderful versatility and profound knowledge of the various branches of engineering which he studied and investigated. The usefulness of this practice can hardly be impressed too strongly, especially on young men.

These, then, are the reasons for devoting an article to the description of a system by no means new, but the knowledge of which is not generally disseminated among engineers and railroad men for preserving and recording useful information.

This system is that usually called the "card catalogue" system, from the fact that it was first employed in making and maintaining catalogues of libraries. The old method of making catalogues for libraries was to record, alphabetically, in a book, the titles of the volumes and the authors' names. It is obviously impossible, even with the minutest subdivision, to keep a catalogue of a growing library alphabetically consecutive. Therefore, the plan was adopted of putting the title of each book on a separate card, and arranging those alphabetically in suitable compartments in drawers, so as to be easily accessible. As soon as a new book is received in the library its title is put on a card and the card is placed in its proper alphabetical position, and thus the catalogue is always perfectly complete and consecutive. This same system is now used in the establishment of Messrs. William Sellers & Co., in Philadelphia, for keeping a list of drawings in their office. Its convenience for such purposes is very great, and its adaptability to the preservation and classification of memoranda was very soon recognized, and those who have used it are very loud in their commendation of its advantages. Before these are explained, the arrangement which is used in a special case will be described.

Cards are used 3¼×5¼ in. in size, made of white Bristol board, although a cheaper quality of material would answer. If the cards are to be used by only one or a few careful persons, what is known in the trade as Weston's linen record paper, which weighs 60 pounds per ream for a size of sheets 21× by 32 in., is heavy enough and costs much less than Bristol board. (Parenthetically it may be added that this is a very excellent drawing paper, and is used exclusively in the drawing-room of the *Railroad Gazette*.) The cards may be ruled or not, to suit the fancy of those who use them. Those referred to above are ruled on one side with lines ¼ in. apart.

Besides these there are 26 red cards, 3¼ x 5¼ in. each, with one of the letters of the alphabet on its upper edge. As these cards are made ¼ in. wider than the others, their upper edges project above the white ones, and the latter can thus be readily seen.

The method employed of recording memoranda, and of classifying them, may be best illustrated by an actual example. A short time ago, the General Manager of the New York elevated railroads gave the writer the weights of the cars used on these roads. As these figures are likely to be needed in the future, they were recorded in a card. Now, in order that the memorandum may be found, it must have an index title which a person seeking the information recorded would naturally look for. In this case the title would evidently be "Cars." But there are already cards with the titles "Car-axles;" "Cars, coupling;" "Cars, number of;" "Cars, Passenger;" Cars, Price of;" "Car-seats," Car-shops," and "Car-trucks;" therefore there must be a subtitle, which appropriately would be "Cars, weight of." The memorandum on the card then reads:

"*Cars, weight of—The cars built by Gilbert, Bush & Co. for the Third Avenue Elevated Railroad of New York weigh* 23,870 *lbs.*

"*The cars built by the Pullman Company for the Sixth Avenue line weigh* 24,130 *lbs.*"

This card is then dropped into its appropriate place, between the red cards marked *B* and *C*, and is thus indexed. The number of memoranda, may, however, soon become so great that divisions by single letters of the alphabet alone will not be sufficient for convenience in finding what is sought. To provide for this, blue cards of the same size as the red ones are provided, which have three index letters in them the same as the headings of a dictionary, so that the cards under each letter of the alphabet may be again subdivided as often as required for convenience.

One of the difficulties, in fact the chief one, in the system is that of knowing at times under what title things should be indexed. Thus should the weight of car wheels be indexed under "weight," "car," or "wheels?" Should "Technical education" come under T or E? Poole, the author of "Index to Periodical Literature," laid down the obvious principle, which, however, is not always easy to apply, that the title should be selected "under which the reader would be most likely to look for the subject." When there is no such obvious title the thing to do is to select that one which appears to be most obvious, and then make cross references. Thus "weight of car

wheel" might be indexed under "Wheels" and then under "Car Wheels," say "see wheels," and under weight say "see wheels; weight of." A little practice, however, soon gives facility in dealing with ordinary cases of this kind.

The cards are kept in the drawers of an ordinary library table. Each of these drawers is 19×18 in., and has three compartments 5¾ in. wide, 4 in. deep, and 19 in. long, in side measurement. At the end of each compartment there is a block of wood, whose length is equal to the width of the compartment. The cross-section of the blocks is a right-angle triangle, the base of which is 2¾ in. and the perpendicular 3¾ in. The perpendicular side is placed against the ends of the drawers, and the hypothenuse side thus affords an inclined surface for the cards to lie on for convenience of examination.

Clippings from newspapers, if not larger than one of the cards, are simply pasted on one, and an index title is written on the upper right-hand corner. For clippings larger than the cards, envelopes of the ordinary kind are provided, of the same size as the cards. The clipping is folded and put in the envelope, and the index title written in the same position on the outside of the envelope as it is on the card.

In most cases it will perhaps be found more convenient to select a certain size of envelope from those made regularly for the trade, and then have the cards cut to correspond with the size of the envelopes. An ordinary envelope 3¾×6 in. would answer very well. Envelopes which are not gummed are a little more convenient to handle.

It will happen that on some subjects so much material will be collected that an ordinary envelope will not hold it all. To provide for such cases what are called box or document envelopes are used. These are made of heavy Manilla paper 4 in. wide by 9½ in. long and ¼ in. thick. The index title of these is written on the ends, and they are kept in pigeon-holes about 4½ in. square by 9½ in. deep. When there is so much material relating to a given subject that an envelope of this kind will not contain it, a whole pigeon-hole is devoted to the one subject. The pigeon-holes are of course separate from the table. These may be arranged in any way that is convenient. In the special instance described an ordinary cheap wardrobe, such as can be bought for a few dollars in any furniture store, was taken and divided up into pigeon-holes 4½, 6½, 9½ and 20½ in. wide. The small ones take the large envelopes, those 6½ in. wide will take ordinary pamphlets and those 9½ and 20½ in. wide will take larger documents. The wardrobe is 13 in. deep, but the pigeon-holes are made only 10 in. deep. The pigeon-holes should all be numbered and the index title of the subjects contained in them should be entered on a card with a reference to the number of the pigeon-hole. The number of the pigeon-hole should also be written on the envelope, pamphlet or other document contained in it so that it may be returned to its proper place.

For the storage of pamplets, paper boxes 12 in. long by 8 in. wide and 3½ in. deep are also used. These are kept on ordinary shelves, and should be numbered and the pamphlets indexed in the card list. Of course, a library catalogue could also be included among the cards if desirable, and sub alphabetical lists can be added wherever desirable. Thus addresses of various people are kept under the title of "Addresses," but the names are arranged alphabetically in the single space devoted to them.

In fact, this system is suited to the needs of any occupation or profession, and to any business or office, and may be universally applied, and is equally well suited for keeping a housewife's domestic receipts, a railroad engineer's notes and data, or a prime minister's memoranda on diplomatic affairs. It has the advantage of being suited to the smallest as well as the greatest affairs. A boy or a student may begin it with a cigar-box and a few pieces of stiff paper cut to the size of a postal card, or the affairs of a great railroad, or the accumulated affairs of a life time may be recorded in this way.

It seems, in fact, as though the time has come when it will be necessary to adopt some great and comprehensive system of indexing knowledge to make it available. The bulk of it is now so great and increasing with such fearful rapidity that it is beyond the power of a single mind or individual to make use even of that relating to a narrow specialty. Perhaps few realize how much knowledge passes into oblivion. Reference is not made to what was known in ancient times, but if any person will make a thorough search, say in a great library, for information concerning almost any subject, he will constantly be surprised by discoveries, in literature not older than many living people, as unexpected as the finding of buried treasures.

It is easy to grow enthusiastic over this system. Its convenience is so great, the amount of work required is so little, that a person with even a moderate amount of time and industry will be able to do a great deal with it. A few cards can be carried in a pocket-book, and notes made at any time or place. To record such memoranda all that is needed is to drop the card into its proper place. It is then indexed, and will be preserved so that it can be found at any time.

If this system came into general use, what a heritage many persons would leave to those who succeed them. Instead of what may be called an incoherent mass of material, the memoranda they leave behind would be classified and indorsed so that it could be used as well by their successors.

Another scheme suggests itself. What is there to prevent two persons from agreeing to duplicate and exchange their notes on cards? The amount of data thus accumulated by each, supposing that they were equally industrious, would thus be doubled. If two persons could do this, why not twenty, two hundred, or two thousand, which brings us face to face with an organization of persons interested in the same subjects, and who would agree to forward all useful notes, memoranda, etc., to a central repository, there to be carefully edited, then printed on cards, and distributed among the members. Conceive of the usefulness of such an organization, if it employed a competent person to summarize the useful information contained in the current technical literature of the day into somewhat the form in which it is given in pocket-books, then have it printed on suitable cards, and distributed among members ready to be classified and indexed with other useful information of a like kind.

This system of keeping notes, memoranda, etc., has been described here at length, on account of its great usefulness to railroad men, especially those engaged in the mechanical and other engineering departments.—*Railroad Gazette.*

NEWS OF THE WEEK.

WESTERN UNION TELEGRAPH.—In the Reiff suit to enjoin this company from completing the lease of the Mutual Union Telegraph lines, the New York Superior Court has given a decision which is, in effect, that the lease is not illegal, but that it should have been ratified by the stockholders at a meeting called for the purpose, instead of by assents in writing. The preliminary injunction is, therefore, continued until further trial of the suit, or until a meeting is called and the lease ratified according to the law.

WOODRUFF SLEEPING AND PARLOR COACH CO.—This company has now 77 of its sleeping and parlor cars in service. The capital account, representing the cost of these cars and appurtenances, is $776,744. For the year ending Nov. 30 last, the earnings of the company were $89,411; the expenses, interest and dividends amounted to $66,902, leaving a surplus of $22,509 to the current year.

INCREASED ALLOWANCE FOR SURVEYS ASKED FOR IN MONTANA.—The Territorial Legislature of Montana adopted a joint memorial, which was received too late for presentation to Congress, asking for the restoration of the old rates allowed for public surveys in the Pacific States and Territories. The memorial says that the present reduced rates allowed for public surveys threaten to prevent any future surveying of the public domain within the Territory or throw it, if done at all, into incompetent hands. The experience of the last season proved that no good work can be done in Montana at the present allowance, save at a loss which no responsible surveyor would willingly incur. The completion of the Northern Pacific Railroad the present year insures a large immigration, and a very large increase of surveying is needed to meet the reasonable demands, whereas without any increase of allowance we shall have little or none whatever. Ruling rates of wages and expense of living have always been and still are relatively higher in Montana than in the States, or in other Territories where the work is relatively easier. Under the law appropriating for the sundry civil expenses of the government the rates for public surveying are the same as those provided in the law of last year, an exception being made in Oregon and Washington Territory, where, if for any cause not provided for by law the Commissioner is unable to get the necessary surveys made at the ordinary rates, he may allow a sum not exceeding $12 per linear mile for standard lines, $10 for township lines and $6 for section lines. The prevailing rates are not exceeding $9 per linear mile for standard and meander lines, $7 for township and $5 for section lines, except that the Commissioner of the General Land Office may allow for the survey of the standard and meander lines through lands heavily timbered, mountainous or covered with a dense undergrowth, a sum not exceeding $13 per linear mile for standard lines, $11 for township and $7 for section lines.

MORRIS & PHILLIPSBURG R. R.—A charter has been granted to this road in Pennsylvania. It is proposed to build from a point in Clearfield County where the Beech Creek, Clearfield and Southwestern Railroad crosses the Moshannon creek, to a point near Beaver Run, in Decatur township, Clearfield County. The length is seven miles. The capital stock is $70,000, and D. W. Holt, of Phillipsburg, is President. The directors are all residents of Phillipsburg.

WISCONSIN CENTRAL R. R.—This company intends to extend its line north from Green Bay to Sturgeon Bay, Wisconsin.

A TEXAS BRIDGE COMPLETED.—The bridge over the Brazos River on the Navasota branch of the Santa Fé railroad, is completed.

STREET PAVING PROBLEM.—Gum wood for street paving has many strong advocates in St. Louis. The wood grows abundantly on the bottom lands of the Mississippi.

A NEW PENNSYLVANIA RAILROAD.—It is proposed to build a road from York to Dillsburg.

DENVER & TEXAS ROAD.—This road has filed articles of incorporation in Colorado. Capital $600,000. The road will be a continuation of the Denver and New Orleans from Pueblo, to meet the Texas and Fort Worth Railroad.

WABASH, IND., WATER-WORKS.—Water-works for the above city are now a certainty. Outside capitalists have signified a willingness to take hold of the matter, and three bids are being prepared. One, that of Dukes & Co., of Peru, will be presented to the city council next Monday evening, and the others later. Dukes & Co. will agree to construct and operate the works, providing the authorities will grant them the sole water privilege of the place, and contract for seventy fire plugs at $100 each per annum. The subject will be finally disposed of as soon as the two other bids are submitted.

WATER SUPPLY FOR FRANKLIN, MASS.—A company has been formed to furnish a system of water-works.

WAKEFIELD, MASS., WATER SUPPLY.—The Quannapowitt Water Company has contracted with the Knowles Steam Pump Works for pumping machinery for supplying Wakefield and Stoneham. The specifications call for two compound condensing engines. Each engine is to be able to pump one million gallons in twenty-four hours against full reservoir pressure. Each of the engines is to be provided with an independent air pump and condenser of improved pattern. Two horizontal boilers of return flue, tubular pattern, each of about seventy horse-power, to be set in heavy brick work, with double expansion walls, are to be provided with two independent feed pumps of the outside plunger pattern. The capacity of the works will be sufficient for a population of twenty-five thousand.

THE CANADA SOUTHERN.—The Attorney-General has rendered an opinion on the proposition of the Canada Southern Railroad Company to construct a bridge across Niagara River. An act of the Canadian Parliament authorizes the erection of such bridge as far as Canada is concerned, when similar authority is given by the American Congress or by the President of the United States. The Attorney-General in his review of the case says no action has been taken by Congress in the matter and the President has no power under the constitution or laws to grant the necessary authority.

WATER-WORKS FOR SOUTHINGTON, CONN.—The Southington Water Company was organized March 27; capital $100,000. Directors are O. W. Stow, T. H. McKenzie, R. A. Neal, J. F. Pratt, J. B. Savage, A. Bradley. The officers are, President, O. W. Stow; Vice-President, J. B. Savage; Secretary T. H. McKenzie; Treasurer, Stephen Walkley. T. H. McKenzie was appointed engineer and instructed to make careful surveys of the proposed resources of supply both by pumping and by gravity. He was authorized to employ a consulting engineer, and to report to a future meeting of the directors. The company is authorized to issue bonds to an amount equal to its capital.

THE GULF AND SHIP ISLAND RAILROAD SCHEME.—New York capitalists are seeking to revive the grant of public lands made in 1856 to aid in the construction of 120 miles of railroad from Canton to Mississippi City; the grant is estimated at 652,800 acres, and much of the land is worth $25 per acre for timber, or would be if the railroad were built through it. It is estimated that the land grant is worth more than the railroad would cost. The proposition is to carry the railroad on a trestle from the mainland to Ship Island, and construct here a great gulf port that would threaten the supremacy of New Orleans.

PROFITS OF THE TELEPHONE.—The annual meeting of the Bell Telephone Company was held in Boston on the 27th. The total earnings for the year amounted to $1,576,031.57, against $1,001,924.91 the previous year. The expenses were $603,987.29, against $439,862.76 the year preceding; net earnings for the year, $972,044.28; balance of income from previous year, $126,034.58; total $1,098,078.86. The total of the previous year

was $606,535.01. Dividends paid, $595,000; carried to surplus account, $334,997.32; balance of income account, $168,681.54; total, $1,098,078.86. The increase of interchanges of telegraphic union doubled last year. The sales of instruments for export decreased and are likely still further to decrease, as foreign countries are making good instruments of their own. It was voted to increase the capital stock from $7,300,000 to $9,800,000.

PHILADELPHIA & READING R. R. PROJECTS.—It is rumored that this road is contemplating the construction of a new station at Ninth and Arch streets, Philadelphia.

THE CHICAGO CABLE RAILWAY.—The Secretary of Illinois has licensed the Cable Railway Construction Company, of Chicago, capital stock $50,000. The incorporators are Daniel J. Miller, Frank D. Degolyer and Geo. C. Fry.

WATER SUPPLY OF LYNN, MASS.—The City Council has appropriated $1,000 for making inquiries as to the desirability of Saugus River for a water supply.

CARTHAGE & ADIRONDACK RAILWAY CO.—This company has been chartered in this State, the road to be constructed, maintained and operated in the State of New York from the village of Carthage, in the County of Jefferson, and several towns and counties in the State, capital stock $500,000.

ENGINEERS STRIKING.—The engineers on the Nickel Plate Railroad have struck. The company wanted them to work twelve instead of ten hours a day.

BITUMINOUS ASPHALT.—A new application of bituminous asphalt for paving has been made in England with such good results as to merit attention here. Limestone is crushed, heated and mixed with the bitumen at 252° Fahrenheit. The combination is then pressed into rectangular blocks in molds under a pressure of about fifty tons, and the blocks are cooled off in cold water. The pavement thus formed is of great density, and the angular points of the limestone, developed by wear, make it rough, affording secure foothold for horses. It is said to wear well.

LIGHTING A CANTON BY ELECTRICITY.—A scheme is proposed for lighting the whole of the Swiss Canton of Vaud by electricity. The motive force would be derived from turbines of 5,000 horse-power at Vallorbes, and the water supply being constant and abundant, it is believed that gas, which is very costly in Switzerland, may be entirely dispensed with throughout the district.

THE FRENCH CHANNEL TUNNEL COMPANY have decided to suspend operations at Sangatte, France. The principal reason for this is that the company desire, before incurring further expense, to ascertain what are the intentions of the English government on the matter. During the time that the works are suspended the boring machine will be removed from the heading, thoroughly overhauled, and several improvments effected, in order to obtain higher rate of speed. At the present time the length of the tunnel is very little under a mile and a quarter.

A TINKER'S DAM.—What is a tinker's dam? Why should a tinker want a dam, and of what use is a dam to a tinker, in or out of his profession?—*Graphic.*

As our esteemed contemporary is in pursuit of information, we will reply that a tinker's dam is a dam of dough or other suitable material, constructed by a tinker to confine his molten solder to the business at hand; and that, inasmuch as when a tinker's dam has once served its purpose it possesses little or no commercial value, the phrase has come to be a frequently used and almost universally understood synonym for worthlessness.—*N. Y. Sun.*

FREE R. R. PASSES IN PENNA.—March 27 the Pennsylvania Senate, by a vote of 22 to 14, passed a measure providing that hereafter no railroad company should issue passes to any persons except their officers and employees. A fine of $500 and imprisonment not exceeding six months is provided for.

COMPLETED.—NATCHEZ, Miss., March 27.—The Jackson railroad and telegraph line is completed.

RAILROAD WRECKERS.—PHILADELPHIA. March 29.—The temporary bridge erected by the Pennsylvania Railroad Co. over Second street pike at Venango street was destroyed last night by workmen in the employ of a leased line of the Philadelphia & Reading Railroad Co. Litigation will undoubtedly follow.

THE ORIGIN OF THE BELL-ROPE.—One of the pioneer conductors of the New York and Erie Railroad was Capt. Ayres. He ran the only train then called for between the terminal points. It was made up of freight and passenger cars. The idea of the engineer, without any knowledge of what was going on back of the locomotive, having his way as to how the train was to be run, did not strike the captain as being according to the propriety of things. He frequently encountered a fractious passenger who insisted on riding without paying his fare. As there was no way of signaling to the engineer, and the passenger could not be thrown from the train while it was in motion, the conductor in such cases had no choice but to let him ride until a regular stop was made. Capt. Ayres finally determined to institute a new system in the running of trains. He procured a stout twine, sufficiently long to reach from the locomotive to the rear car. To the end of this string next the engineer he fastened a stick of wood. He ran this cord back over the cars to the last one. He informed the engineer, who was a German named Abe Hammil, that if he desired to have the train stopped he would pull the string and raise the stick, and would expect the signal to be obeyed. Hammil looked at the innovation as a direct blow at his authority, and when the train left the station he cut the stick loose, and told Capt. Ayres that he proposed to run the train himself, without interference from any conductor. The next day the Captain rigged up his string and stick of wood again. "Abe," said he, "this thing's got to be settled one way or the other to-day. If that stick of wood is not on the end of this cord when we get to Turner's, you've got to lick me or I'll lick you." The stick was not on the string when the train reached Turner's. The Captain pulled off his coat and told Hammil to get off his engine. Hammil declined to get off. Capt. Ayres climbed to the engineer's place. Hammil started to jump off on the opposite side. The conductor hit him under the ear and saved him the trouble of jumping. That settled forever the question of authority on railroad trains. Hammil abdicated as autocrat of the pioneer Erie train, and the twine and stick of wood, manipulated by the conductor, controlled its management. The idea was quickly adopted by the few roads then in operation, and the bell or gong, in time, took the place of the stick of wood to signal the engineer.—*St. Louis Globe Democrat.*

THE ELEVATED RAILROADS, MASS.—By a vote of 104 to 74 the Massachusetts House, on March 22d, read a second time and ordered to a third reading the bill providing for the incorporation of elevated R. R. companies to construct and operate roads on the Meigs patents. Country members mainly made up the affirmative vote.

MARBLEHEAD WATER CO.—A petition has just been presented to the State Committee on water supply and drainage of Massachusetts for the organization of the above company, the supply to be obtained from Glenmere Lake, Lynn.

OPENING OF THE CHICAGO EXTENSION.—It is announced that the Chicago and Atlantic R. R. will be formally opened for local business April 15th. A contract has just been closed for 46 engines and 1,500 more cars.

PITTSBURG, CLEVELAND AND TOLEDO R. R.—Track-laying began on this road last week at the terminus of the road near Akron, O., and is steadily progressing towards Cuyahoga Falls.

NORTH PACIFIC RAILROAD.—Bozeman celebrated the arrival of the first Northern Pacific train over the Belt Range of the Rocky Mountains March 21st. Six thousand persons were present. Northern Pacific trains now run regularly to Bozeman, and a track is laid five mile west of that city.

MISSISSIPPI RIVER IMPROVEMENTS.—The Commission left Cairo, March 13th, for the purpose of inspecting the works in progress. Owing to the failure of Congress to pass the necessary appropriations, a considerable reduction in the engineering force is expected, and one of the purposes of the commission's visit is to select those who are to be retained. There are at present, some thirty engineers on the civil list engaged on the Red, Yazoo, and Blackwater Rivers.

BELT RAILROAD IN ST. LOUIS.—A franchise has just been granted for a belt road, with power to connect its tracks with any commercial or manufacturing establishment on its line. It is to be located on the street grade; not to charge over five cents for any distance not exceeding five miles, and for each additional mile one cent. The tracks laid are to be a public highway, and any railroad company entering the city of St. Louis shall have the right to run its trains over such tracks by paying the Belt Company a just compensation. The franchise is granted for fifty years, and after the annual gross earnings have reached $75,000, and until they reach $150,000, the company shall pay to the city of St. Louis 1 per cent. of this amount; when the gross earnings exceed $150,000 annually, and until they reach $235,000, they shall pay 1½ per cent. to the city, and when these earnings equal or exceed the last named amount, they shall pay 2 per cent. upon the total amount of its gross earnings; all general taxes prescribed by law are in addition. The Belt Company is to file a bond of $100,000 for fulfilment of the imposed conditions.

DEFINITION OF A "TRUNK LINE."—As the railroad man of the *Enquirer* entered the office of the Missouri Pacific, on Vine Street, yesterday, a debate of no mean dimensions was in progress. Collected together were numerous railroad men, and the subject being discussed was "What is a trunk line?" Various opinions were expressed. One of the gentlemen—a new man in the business—said a trunk line was a line that carried trunks. To which another responded: "Then your line is not a trunk line, because the passengers over it never have more than a valise or a bundle." A sage-looking, elderly gentleman, who occupied a back seat, as soon as he could be heard, asserted that a trunk line was one that connected with a seaport. This answer, however, wouldn't do, because others said that there were several lines that had a seaport terminus, and yet are not known as trunk lines. "Why," said an old passenger man, there are but four trunk lines in the United States," and he proceeded to name them as follows: "The Erie, New York Central, Pennsylvania, and Baltimore & Ohio. "That's so," chimed in several. The question was then asked, what peculiarity do these lines possess that they should be the only trunk lines in existence. "I give it up," said Steve Muls. "So do I;" "and I;" "and I," chimed in several others. "Suppose we leave it to the *Enquirer*," was suggested by a man with a tack-hammer in one hand and a paper of tacks in the other. "I second the motion," said Caufy, and it was put to a vote and carried. The reporter will say in his modest way, that is proverbial with reporters, and especially those that have the railroads to attend to, that a trunk line is the main line of any great system of roads, which is fed by and feeds numerous branches connecting with it, whether it may have a seaport terminus or not. It is true that the roads named above are known as the trunk lines, but they do not possess any exclusive ownership to the title, nor have they a copyright on it as a trade mark. Of course, they are very important lines, and all east bound business must go over one or the other of them. The name, it seems, of "trunk lines" has been assigned to them as their especial property since the existence of east bound pool. The name trunk line was, very probably, first used in England, and was applied in this country to the Grand Trunk line of Canada. By referring to the dictionary it will be found that the word trunk means the main body or stem, and, consequently, as before stated, a trunk line is the main body or stem of an extensive system of roads fed by numerous branches, or, in other words, it is an artery in distinction from the feeders, which are the veins.—*Cincinnati Enquirer.*

THE PRESERVATION OF STEEL.—Experiments are at present being carried on in Belgium, says *Iron*, to preserve steel and gun-barrels in particular, by coating them thinly with copper, by a process of which M. F. Weil is the inventor. Its peculiarity consists in the composition of the baths used, in which the usual and always dangerous alkaline cyanures are replaced by organic acids and glycerines. According to M. Weil, these baths require no renewal of organic elements, and can be used continuously, when they are saturated with peroxide of copper. They possess, also, the advantage—owing to the property inherent in organic alkaloids, of disolving the peroxide of iron, without attacking the metallic iron itself—of cleansing the steel before commencement of the coppering process, and more perfectly than can be done mechanically. The coppering is effected by putting porous clay vessels, filled with caustic soda-lye in which zinc plates have been immersed, in the basin containing the organic copper base (alkaloid) and the steel. The zinc plates are connected with the steel articles to be coated with copper by a thick copper wire. The caustic-lye may be used over and over again. Should it become saturated with oxide of zinc, it is sufficient for its regeneration to treat it with sulphide of sodium, when the oxide (of zinc) will be precipitated, and a valuable by-product obtained, by which the cost of the process will be considerably reduced. The coppering process, it is said, occupies but a very short time.

EASTERN AND BOSTON AND MAINE R.R. LEASE.—The proposed lease of the Eastern by the B. & M. R.R. is approved by the press of New Hampshire and Maine.

MONSON (Me.) RAILROAD.—The Directors of the road elected March 22d, H. A. Whiting, of Wilton, N. H., President, and Geo. S. Cushing, of Lowell, Mass., Treasurer and General Manager. The company is now ready to receive bids for the construction of the road.

PEMIGEWASSET (N. H.) R.R.—The first passenger car went over this road March 22d, with officials of the company.

STUDYING THE TIME-TABLE.—"My dear," said Mr. Spoopendyke, running his thumb down the list of towns on the time-table and glaring helplessly at the columns of figures, "my dear, the man must have given me the wrong business. We can never get anywhere with this."

"Let's see," murmured Mrs. Spoopendyke, laying her hand on his arm and drawing the time-table toward her. "There's Boston Lv. and Albany Ar. 2:30 to 2:40. That's plain enough.

"It is, is it?" snorted Mr. Spoopendyke, abandon-

ing the table and bending his eyes on his wife. "Think that's plain enough, do ye? Show me how you make it. If you've got this thing by the tail, wiggle it once for my information."

"Why," fluttered Mrs. Spoopendyke, "you just add 'em together. Ought's ought, four and three's seven; eight and two's ten, put down the ought and carry——"

"Carry swill to the hogs!" roared Spoopendyke, bracing himself in his seat and sureying his wife with marked disapprobation. "That's about as much as you know anyway. What's Boston got to do with it? What interest has Lv. and Ar. got in this thing? Got some kind of a notion that they own the road haven't ye? P'raps ye think one's a tunnel and the other's a bridge. Well they ain't, and they're not half-baked females who don't know a time-table from a dog law. Now, you let me figure this thing if you don't want to spend the balance of your life on the road,"? "Certainly, dear," cooed Mrs. Spoopendyke, nestling up to her husband and glancing around the car to see if he had been overheard, "You can make it out if anybody can."? "Now, we started from New York at 10:30 a.m.," continued Mr. Spoopendyke, "and we got to Buffalo at 12:15 a. m. Then, according to this, we leave Buffalo at 12:35 and 12:40 for Chicago. What I want to know is, why we leave Buffalo twice?"

"I suppose it's to make sure of getting away from there," suggested Mrs. Spoopendyke, fastening her thumb and forefinger on the margin of the time-table with a death grip. "Maybe the engine leaves at 12:35 and the last car at 12:40," she added, as the new explanation occured to her. "Anyhow, it is better to get away from there twice than stay there altogether, don't you think so, dear?" and she looked up at him confidingly.

"S'pose anybody along the line of this road knows what you're driving at?" snarled Spoopendyke, hauling at his end of the time-table. "Let go will ye? Engine leaves at 12:35! Last car leaves at 12:40! That's the idea! It took you to hit it! When I get time to fix you up with a cowcatcher and a schedule of cut rates, I'm going to start an opposition road with you! Now let this thing alone, I tell ye!"

"There it is!" exclaimed Mrs. Spoopendyke, flushing with another discovery. "I've got it now! Of course we've got to leave Buffalo twice to get to Chicago twice," and Mrs Spoopendyke settled herself back and regarded the table with much complacency.

"Oh, you've got it," roared Spoopendyke. "That explains it! This railroad is twins! Leaves everywhere twice and gets everywhere twice! Nobody would have ever found it out but you All you want now is a misplaced switch and a coroner's inquest to be a through trunk line. Can't you see that it's two different trains that get in there at 7:40? S'pose they only run one train on this dodgasted road? Got a notion that the train goes both ways at the same time! I know all about getting there as well as you do, but what I want to understand is how this train leaves Buffalo twice. Got it now? Think you've fathomed my design on this time-table? "Perhaps there are two different trains out of Buffalo, hazarded Mrs. Spoopendyke.

Mr. Spoopendyke deliberately tore the time table into a thousand pieces, dropped them carefully under the seat, buried his hands in his pockets and gazed out of the window.

"I don't care," soliloquized Mrs. Spoopendyke. "There can't two trains arrive anywhere without leaving some place, and, anyway I suppose we'd get to Chicago just as well if we didn't understand about this Buffalo affair."

With which consoling reflection, Mrs. Spoopendyke settled herself in her seat and gave herself up to considering how that girl on the other side of the aisle would act if she knew how much her laughing and loud talking with her escort offended the more virtuous minded of her sex.—*Brooklyn Eagle.*

LOWERING A TUNNEL.—In rebuilding the Pittsburgh & Western as a standard-gauge road an extensive change was made at the Summit tunnel. Its bed was lowered 9 ft. without stopping a train. The work was accomplished by the excavation of the bed of the tunnel while the track was kept up by trestle-work. A row of blasts would be fixed ready for firing, and as soon as a train had passed through they would be touched off and the débris cleared up before the next train arrived. The track for the broad-gauge waslaid 9 ft. below the narrow-gauge, and when all was ready cars were run inon the lower tracks and the trestle for the narrow-gauge knocked down and dragged out.

WATER-WORKS, WILMINGTON, N.C.—The Clarendon Water-Works Company has recently perfected the plans, and as soon as the materials can be procured, will begin the construction of an apparatus for filtering the water, which it is confidently hoped will remove the existing objections to the use of the river water. The device is, in short, a timber box about twenty-five feet square and eleven feet deep, with an intermediate floor of brick, the water being drawn from the lower compartment. The water is admited to the upper part of the box through openings of suitable size, in which will be placed screens of some porous material, such as sponge or felt, that can be readily cleaned as occasion may require. The water can also be shut out and the bricks cleaned or replaced whenever it may become necessary, during which time the supply will be kept up by drawing direct from the river by the present inlet pipe. The company has also lately completed an addition of twenty feet to the top of the stand-pipe, making it now ninety feet in height, which will give the desired pressure at all times in the elevated porton of the city. The inside staging having been removed, and it being desirable to keep up the stand-pipe supply during the night, the addition was built from a float. The outside staging was also dispensed with, the rivets being driven from the inside and held on the outside by a man in a cage suspended by roller hooks traversing the upper edge of the sheet which was being worked upon. The water was raised as each course of sheets was put on, thus testing the work as fast as completed.

This method was devised by the chief engineer of the works, Mr John C. Chase. The stand-pipe as originally constructed was a plate iron cylinder 20 feet in diameter and 70 feet high, with a cement bottom on a masonry foundation. It leaked badly, however, and, having been abandoned by the contractor, a floor of yellow pine was put in, which has given satisfacton thus far. The addition was built by Mr. R. N. Mitchell, of Raleigh.

IOWA RAILROAD SCHEMES.—COUNCIL BLUFFS, March 15.—Railroad interests have become active as spring opens. The Oskaloosa Western, an air line from Oskaloosa to Council Bluffs, has stimulated energy in other directions. The Western Road is on the route surveyed as the Iowa air line in 1857 by Gen. Curtis. The company is pushing the construction with great vigor, and before summer is over the track will be laid to this city and trains running to another trunk connection with the Union Pacific here. The Wisconsin, Iowa Nebraska, projected from McGrégor, in Clayton County, on the Mississippi, intended as a diagonal road through Waterloo, Marshalltown, and Des Moines to a point on the Missouri, in Southwestern Iowa, opposite Nebraska City, Neb., made good progress last season in a south-westerly direction. Late last season, R. T. Wilson & Co., of New York City, became interested in the scheme, and from that date the plan was changed. The road is built to Waterloo, on the Cedar River, and 20 miles of the interval between Waterloo and Marshalltown. It is proposed to close this gap at once, and then to Des Moines, the capital of the State. From Des Moines the road will proceed southwest to a point midway of the Chicago, Rock Island & Pacific and the Chicago, Burlington & Quincy and thence west in an air line, or nearly so, to Council Bluffs, to form another trunk connection here with the Union Pacific. One surveying party has just left here eastward on the proposed new route. Another occupies the line from Des Moines diagonally toward Nebraska City, which route, in the change of general plan, will not be abandoned. The race to reach this point will be between the Oskaloosa & Western and the "Diagonal." The two lines will eventually be almost side by side. The local advantages to be derived will be by giving to a tier of three counties east of the Missouri River an east and west line that they do not now have, by reason of the great interval between the Chicago, Burlington & Quincy and the Rock Island roads, on the verge of that territory.

PAPER DOME.—Columbia College is having a paper dome built for its observatory. This is the fourth one of the kind in the world. They have all been made by Waters & Sons, of Troy, N. Y.—the manufacturers of paper boats—and are all in this country. The first one made is at the Troy Polytechnic Institute, the second at West Point, and the third at Beloit College. The method used in the manufacture of the paper is kept a secret, the makers using a private patented process. The dome is made in sections—semi-lunes, as they are technically called. There are twenty-four of these sections. They are bent over toward the inside at the edges, and bolted to ribs of wood. The thickness of the shell is only 3-32 of an inch, but it is as stiff as sheet-iron. On one side of the dome is the the oblong opening for the telescope, and over this is a shutter (likewise of paper, but stiffened with wood lining) which slides around on the outside of the dome. The whole dome is so light that the hand can turn it. The side diameter is twenty feet and the height is eleven feet. The floor of the observatory is one hundred feet above the ground.

PRIMEVAL MAPS ON STONE.—In many parts of Switzerland are often found smooth flat stones, evidently hand-polished, and covered with dots, lines, circles and half-circles. The origin and use of these stones, known among country people as "Schalensteine," has long been a moot point among the learned. Some have thought they were charms; others that they were meant to commemorate the dead, or that the signs on them were undecipherable hieroglyphics; but it has been reserved for Herr Rödiger, of Bellach, in Solothurn, to throw a new light on these mysterious relics of the past, and suggest a theory concerning them which seems to meet all the necessities of the case. The Schalensteine, he says, are neither more nor less than topographical charts, as a comparison of them with any modern map of the districts in which they are found will show. The engraved dots correspond with existing towns and villages, the lines with roads. Even the fords and mountain passes are indicated. Herr Rödiger has examined many of these stones from various parts of the country, and he possesses a collection, picked in Solothurn, which form together a map of the entire canton. Another significant circumstance is that the Schalensteine are mostly found at intervals of about two hours (say, six miles) from each other, and at spots where several roads meet. The former Herr Rödiger calls "headstones;" the latter he denominates "by stones." If he be right in his hypothesis, the places where these stones are met with possessed considerable populations long before the dawn of history; even the villages shown on the Schalensteine must be far older than the Christian era. Herr Rödiger considered the Swiss maps-stones to be of the same origin as the similar stones which are found in Germany, Scandinavia, India and further Asia, and sees in them another proof of the high antiquity and common origin of the Indo-Germanic races, and the existence among the latter, in an indefinitely remote age of civilized habits, organized trade and more culture than is generally supposed.—*Geneva Letter in London Times.*

THE IRON AND STEEL MARKETS.

PHILADELPHIA, MARCH 30, 1883.

Between 8,000 and 10,000 tons of forge and foundry iron have sold this week at $24.50 for No. 1, $23.50 for No. 2 and $20.50 for Mill Iron. A few small lots of Bessemer iron have sold at $22.50. English iron is moving in 10 to 50-ton lots at $22@$26. Muck Bars are $35.50@$36; Merchant Bar is $2@$2¼. Demand is improving and manufacturers are accepting orders for future delivery. Competition is active. Nails are selling at $3.15@$3.30, according to size of order. A number of fair orders have been placed for Bridge Iron, and bridge builders and makers of Structural Iron are in negotiation for large deliveries for summer. Common Plate Iron is 2½c.; Shell, 3½c.; Flange, 4¼c. Contracts for pipes have been taken at 70 per cent. off. Negotiations for Cast Pipe are in hand at $35@$37, according to size. Large lots of Gas Pipe are wanted. Steel Rails are active in small lots at $39. Old Rails sold at $24 for Tees, $26 for American, $27.50 for Double-Heads; best Scrap, $27.50; Common, $26; Cast, $19.50.

PITTSBURGH, MARCH, 30, 1883.

An improving tendency is apparent this week in the demand for pig iron. The decline of Lake ore to $8 has produced a better feeling among blast-furnace men, and several large contracts have been already placed. The disposition of the Lake ore companies to deal fairly has improved the tone of the market, and enabled makers of pig iron to come out better than heretofore. Forge Iron is $19@$20; Foundry, $20@$23, according to quality; White and Mottled, $18; Cold Blast Charcoal, $30; Muck Bars, $34; Manufactured Iron, 2c., shaded. Some few mills are well supplied with orders, and nearly all are booking orders with much freedom. Nailmen are holding present prices with much difficulty, and competition is very active. A further restriction is probable. Old Rails are selling at $26, but prices are still too high for shipment from tidewater. Orders for Steel Rails have been booked at $40, and orders are in hand which will run the mills here for months. Merchant Steel is in active demand, but full capacity is not yet engaged. Scrap Iron is dull and weak; Coke is unchanged, at $1.05 per ton; 60 per cent. of Connellsville capacity is engaged; demand is improving.

CHICAGO, MARCH 29, 1883.

Finished iron and nails are in improving demand at 2.30c. for iron and 3.40.c for nails. Southern coke iron has been advanced, and the volume of trade in crude iron generally has improved. Tool machinery and agricultural steel is moving more freely, though at old prices. No attempt will be made to advance quotations until a larger volume of work is secured. Inquiries from the local market and from the Northwest are of an encouraging character, and manufacturing capacity expects to be more fully engaged, though scarcely at higher than present prices.

CINCINNATI, MARCH 29, 1883.

The decline in finished iron, which has been at work here for a few days, will prevent any advance in crude irons. Competition between northern and southern pig is more active and prices are weak. A fair degree of inquiry is coming in for merchant bar, and mills have orders for three to four weeks. Offers for later delivery at current quotations have been refused.